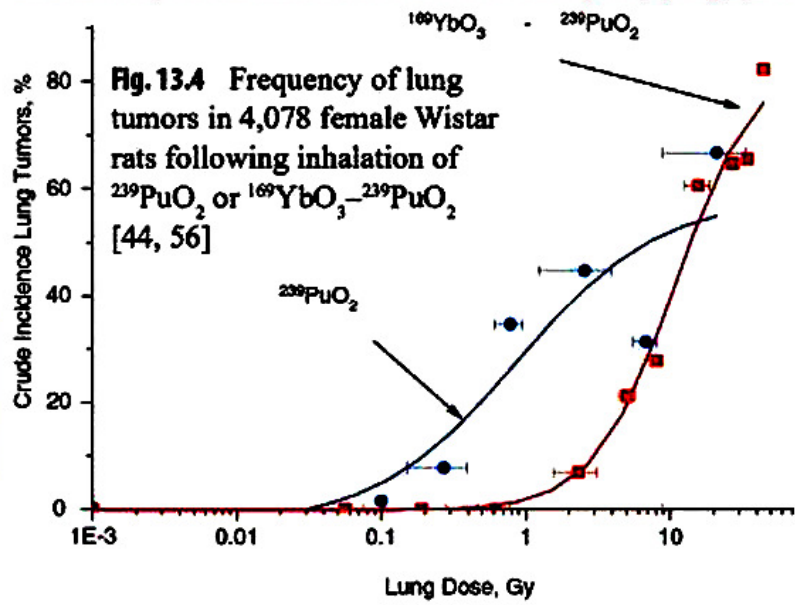
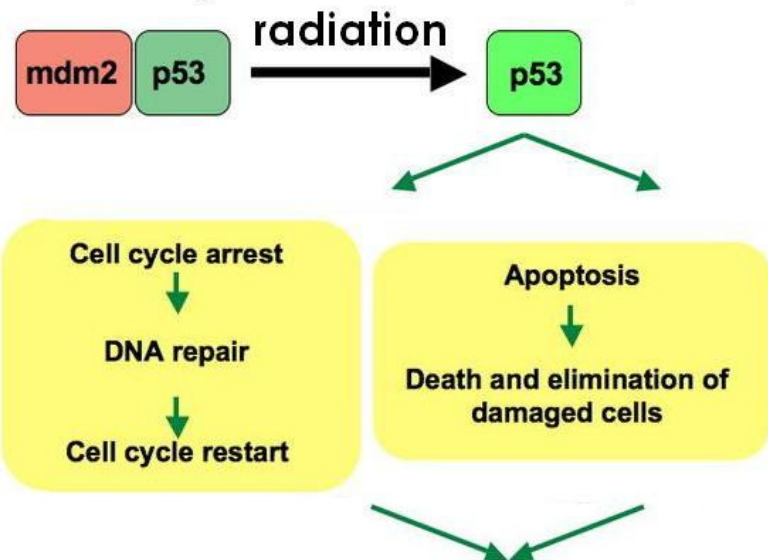
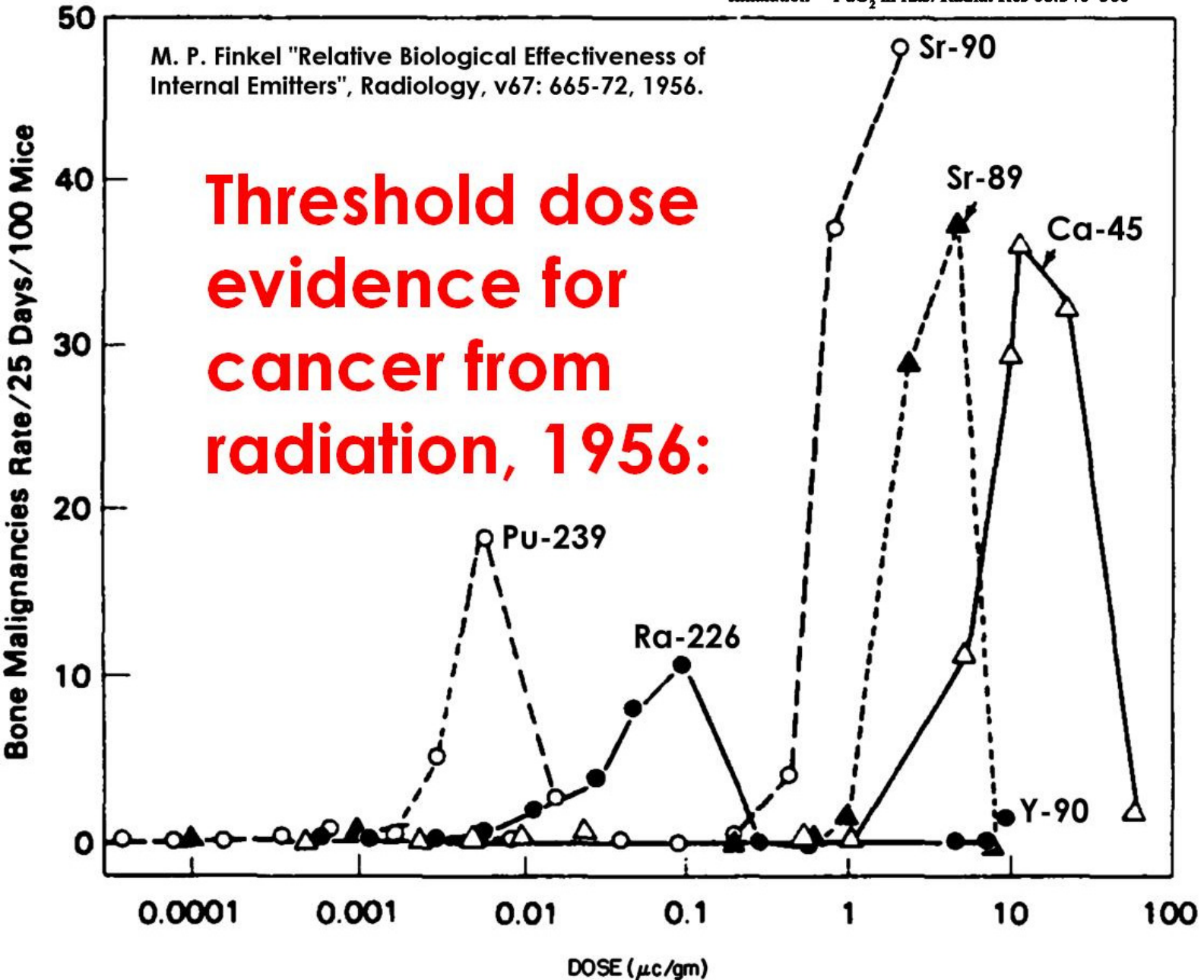


Inactive p53 Active p53

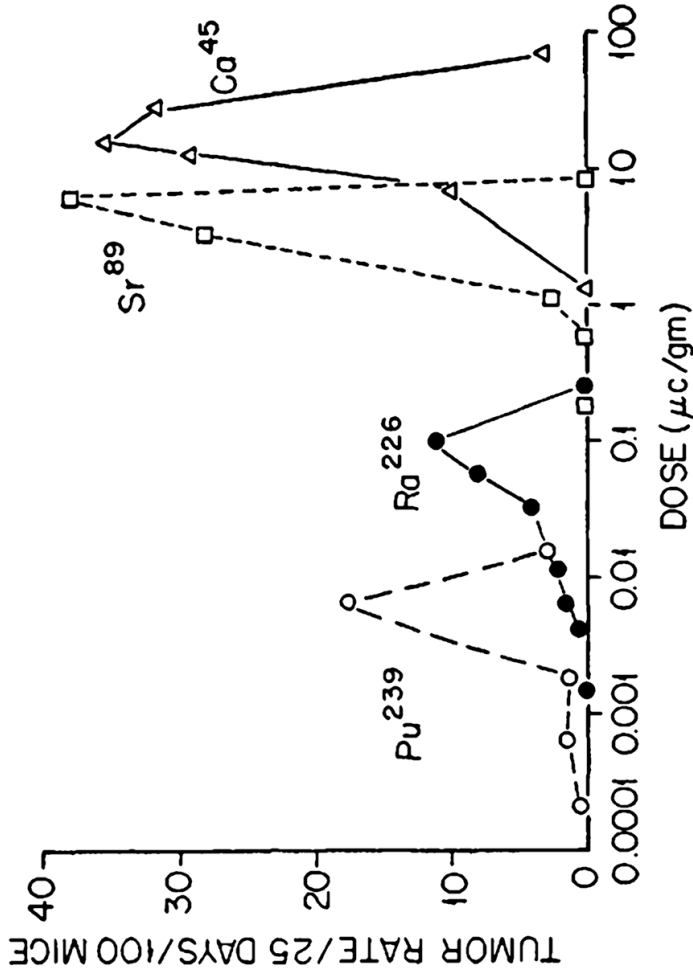


Prevention of cancer or genetic defect at low dose rates (at high dose rates, double strand DNA breaks are too rapid)

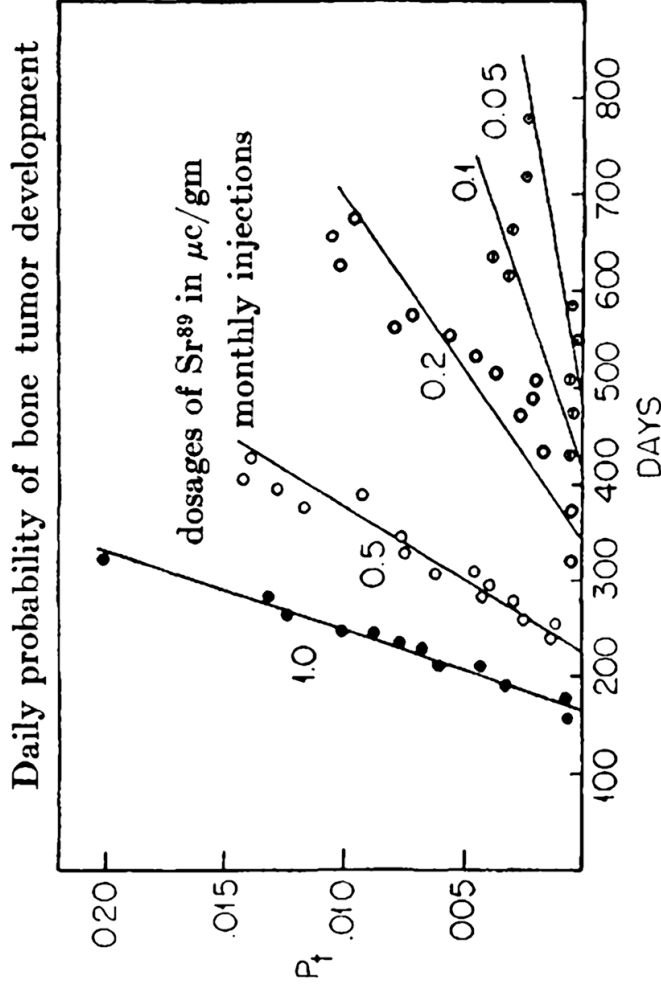
44. Sanders CL, Lauhala KE, McDonald KE (1993) Lifespan studies in rats exposed to $^{239}\text{PuO}_2$ aerosol. III. Survival and lung tumors. *Int J Radiat Biol* 64:417-340
56. Sanders CL, Dagle GE, Cannon WC et al (1976) Inhalation $^{239}\text{PuO}_2$ in rats. *Radiat Res* 68:340-360



Threshold dose rate for bone cancer in mice

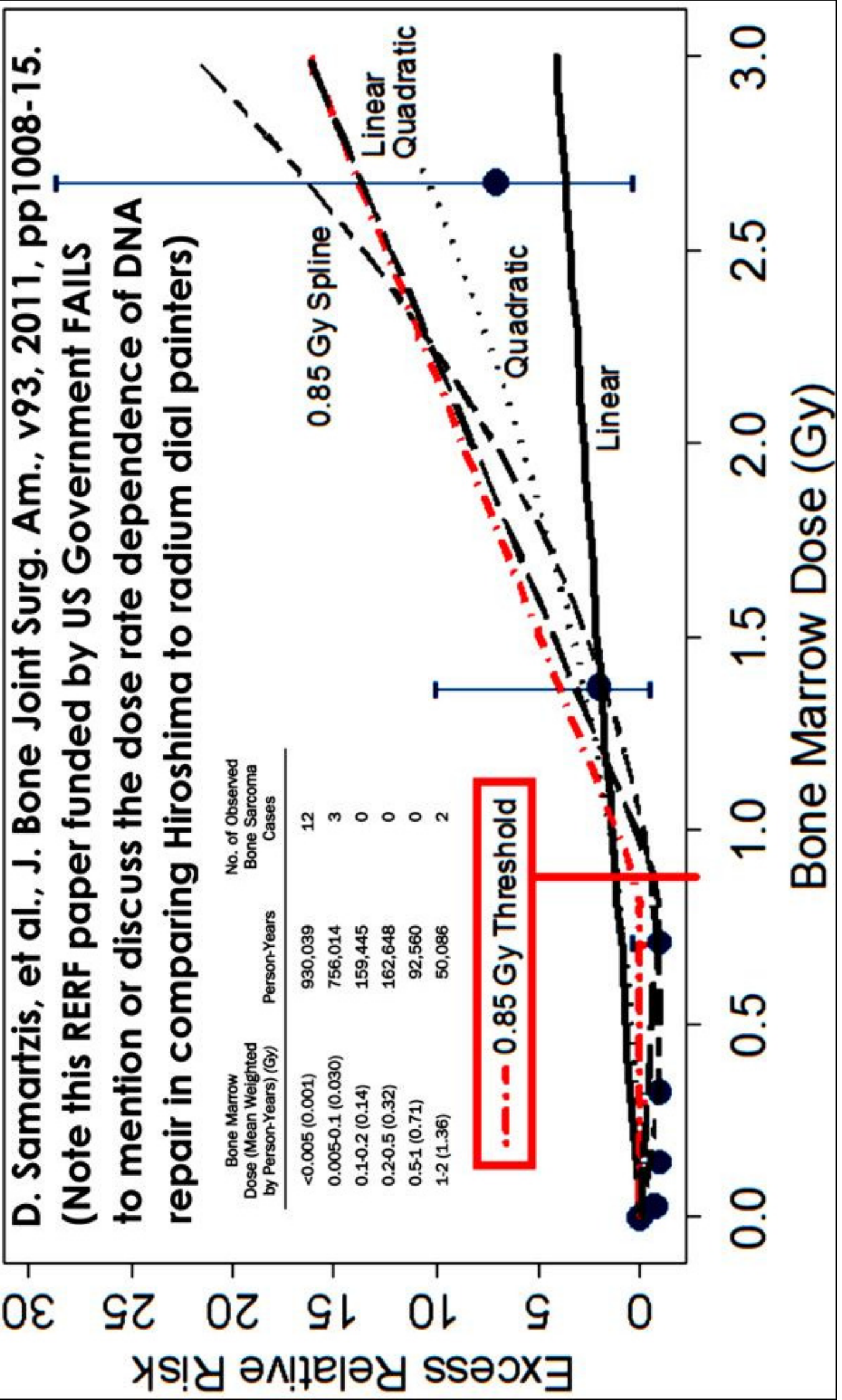


M. P. Finkel "Relative Biological Effectiveness of Internal Emitters", Radiology, v67: 665-72, 1956.



A. M. Brues, "Biological Hazards and Toxicity of Radioactive Isotopes", J. Clin. Investigation, v28, pp. 1286-96, 1949.

Threshold dose and hormesis evidence for bone cancer in Hiroshima and Nagasaki (very HIGH DOSE RATE)



Inactive p53

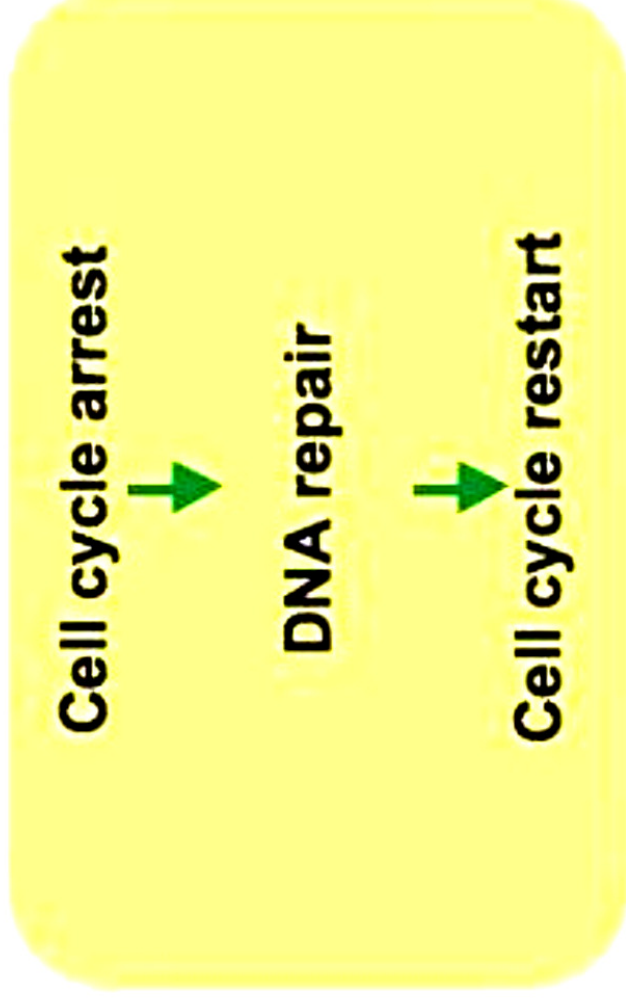
Active p53

radiation

mdm2

p53

p53



Prevention of cancer or genetic defect

Inactive P53 (bound to mdm2)



DNA damage

Stress ↓

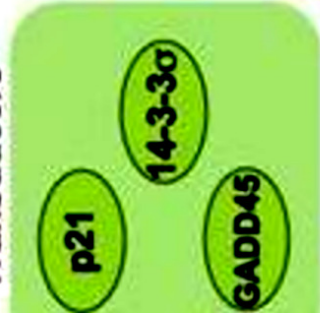
mediators **ATM** **CHK2**



Active p53



Transducers



Cell cycle arrest



DNA repair



Cell cycle restart



Apoptosis



**Death and elimination of
damaged cells**



Apoptosis

CELLULAR AND GENETIC STABILITY



Dose range milli-sievert	Number in 1950	Cancer deaths (excl. leukaemia)		Leukaemia deaths	
		total rate	rate from radiation	total rate	rate from radiation
Less than 100	68467	11.2%	0.09%	0.2%	0.01%
100 to 200	5949	12.3%	0.7%	0.2%	-0.01%
200 to 1000	9806	13.2%	1.9%	0.6%	0.3%
More than 1000	1829	24.1%	8.1%	3.5%	2.4%
All	86611	11.7%	0.6%	0.3%	0.1%

Cancer deaths among 86611 Hiroshima and Nagasaki survivors, 1950-2000

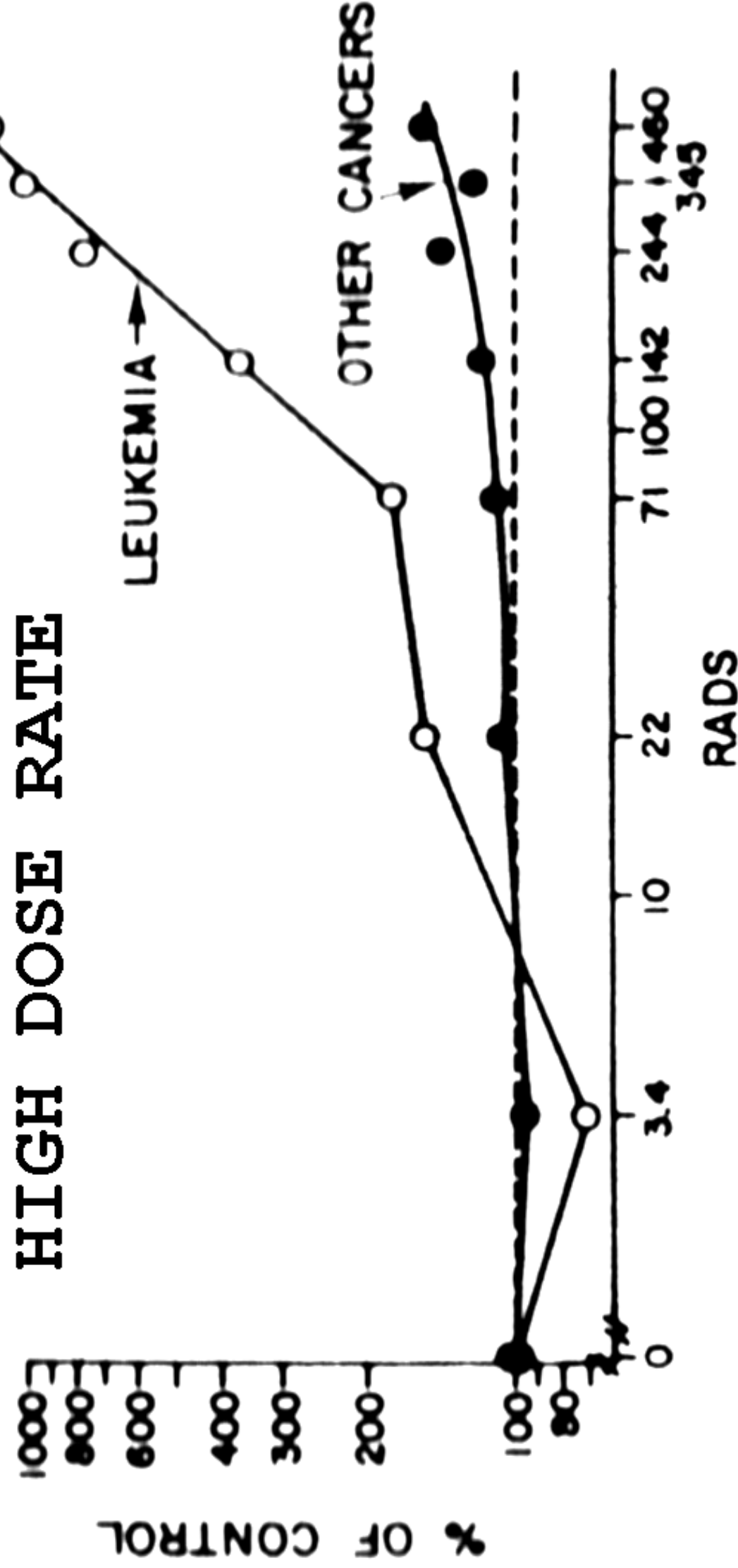
The total radiation-related deaths from solid cancer and leukaemia were 480 and 93, respectively.

<http://www.bioone.org/doi/abs/10.1667/RR3232>

Preston, D. L., Pierce, D. A., Shimizu, Y., Cullings, H. M., Fujita, S., Funamoto, S. and Kodama, K., "Effect of Recent Changes in Atomic Bomb Survivor Dosimetry on Cancer Mortality Risk Estimates," Radiat. Res. v162, pp377–389 (2004).

Source: Dr Wade Allison
1 milliSievert = 100 mR

1950-78 CANCER MORTALITY IN HIROSHIMA-NAGASAKI
Kato + Schull, 1982



31,581 23,073

14,942

4225

3128

1381

PERSONS

639

Radium in Humans

A Review of U.S. Studies

by
R.E. Rowland
Environmental Research Division



Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

September 1994

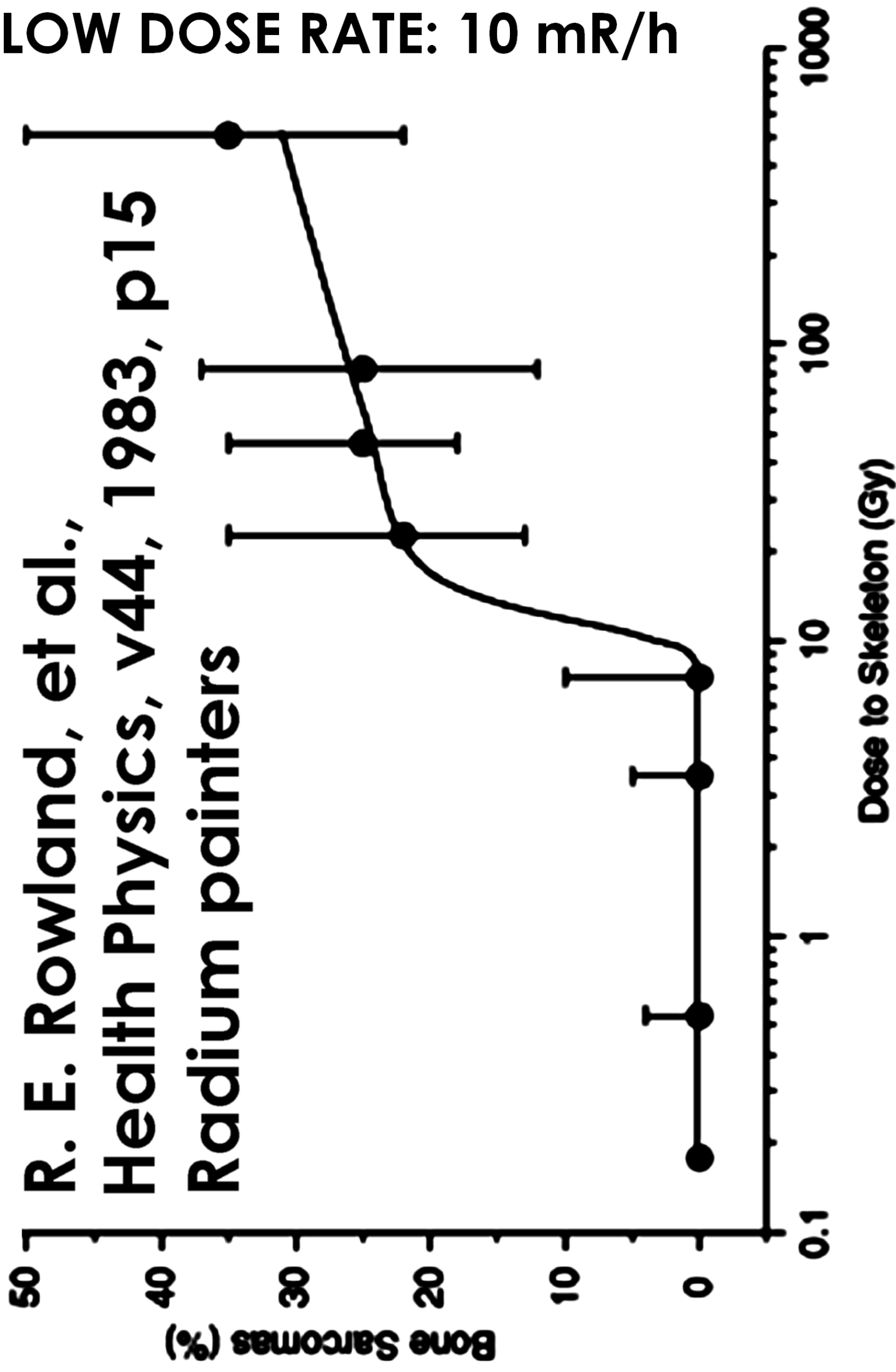
Work supported by the United States Department of Energy,
Office of Energy Research, Office of Health and Environmental Research,
and Assistant Secretary for Environment, Safety, and Health,
Office of Epidemiology and Health Surveillance

The concept that radiation should have its own exposure standards grew from early radiobiological effects on humans working with the new radiation energy sources. The first official exposure standard for a radionuclide in the body was established for ^{226}Ra at a level of $0.1\text{ }\mu\text{Ci}$, by a task group assembled by the U.S. National Bureau of Standards in 1941. On the basis of the average radiation dose to the skeleton from deposited radium, a “practical threshold” dose of 10 Gy was established many decades ago by the pioneer of the work contained in this book, Dr. Robley Evans, then at the Massachusetts Institute of Technology. It was Evans who, through appearances before the Atomic Energy Commission and congressional committees, spearheaded the establishment of the Center for Human Radiobiology at Argonne National Laboratory in 1968.

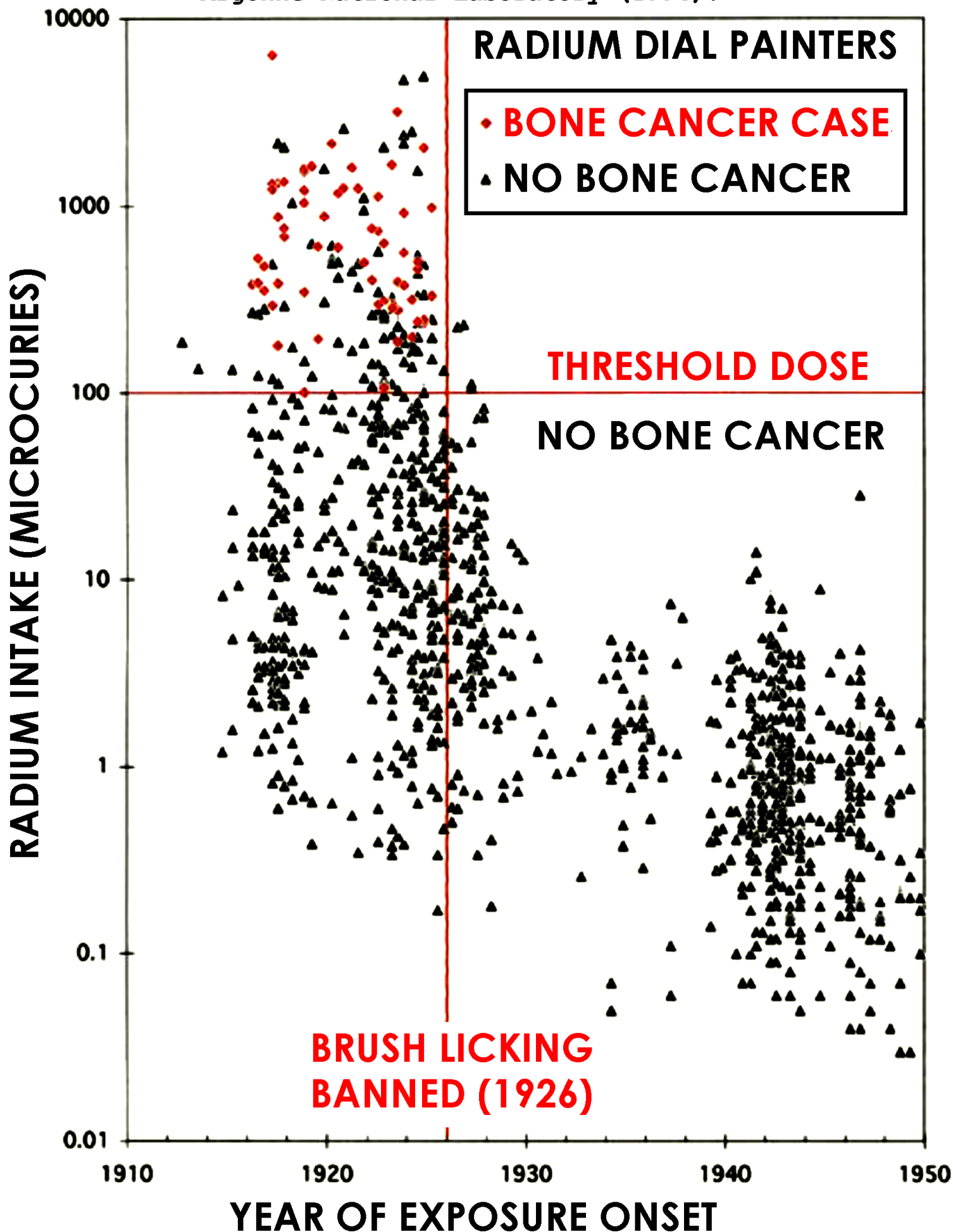
xī
Robert G. Thomas
Program Manager
Environmental Research Division

LOW DOSE RATE: 10 mR/h

**R. E. Rowland, et al.,
Health Physics, v44, 1983, p15
Radium painters**



Rowland, R. E. Radium in Humans: A Review of U. S. Studies, Argonne National Laboratory (1994).



REVISED - "PLANET OF THE APES" - 5/23/67

ZAIUS

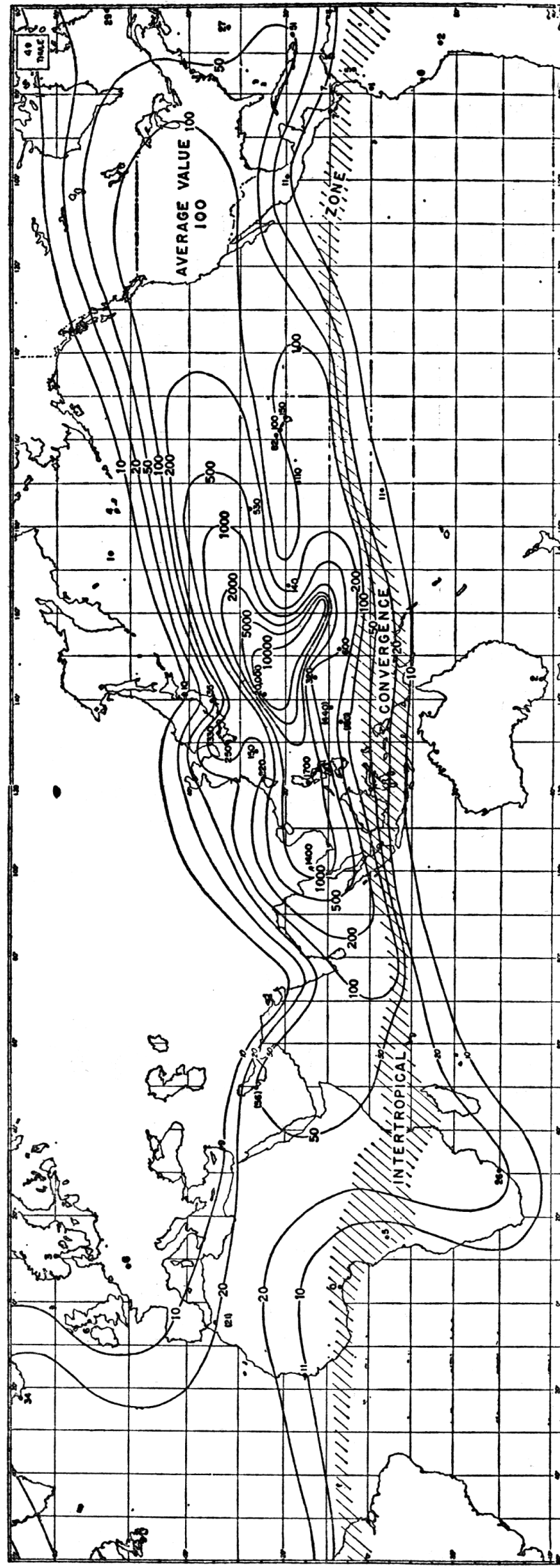
I've seen some of your fossils and artifacts. They're worthless.

TAYLOR

(derisively)

And that's your Minister of Science. Honor-bound to expand the frontiers of knowledge.

Except that he's also the Chief Defender of the Faith.



MIKE shot global fallout at 35 days, beta millicuries per 100 square miles
(From page 168 of the 1957 U.S. Congressional Hearings on fallout.)

~~CONFIDENTIAL~~
UNCLASSIFIED

Mr. Coyne



RADIATION FALL-OUT" CONTROVERSY
UNITED STATES DEPARTMENT OF JUSTICE
FEDERAL BUREAU OF INVESTIGATION

WASHINGTON 25, D. C.

June 19, 1957

PERSONAL AND CONFIDENTIAL
VIA LIAISON

Honorable Robert Cutler
Special Assistant to the President
Executive Office Building
Washington, D. C.

DECLASSIFIED BY 275 WFW/mdm
ON 1/19/88
NLE 87-232

Dear General Cutler:

I thought you would be interested in the results of an analysis of the controversy being waged at the present time concerning the hazards of radiation effects from nuclear bomb tests, and I am enclosing a copy of this analysis for your information. Your attention is invited to the brief Introduction which appears at the beginning of the enclosure. u

This analysis reveals some of the efforts being made by communists on an international level and also by the Communist Party, USA, to exploit the present "fall-out" controversy. An outstanding feature of this controversy concerns the numerous scientists with subversive affiliations who have become associated with it. Dr. Linus Pauling, Harlow Shapley, and Edward U. Condon, familiar names in the field of science frequently associated with communist front activities in the past, are among those creating fear, misunderstanding, and confusion in the minds of the public on this issue. u

Sincerely yours,

Enclosure

~~CONFIDENTIAL~~
UNCLASSIFIED

DECLASSIFIED	
Authority	MR 87-232 #9
By	Lko
Date	1/29/88
NLE Date	

UNCLASSIFIED
CONFIDENTIAL

**COMMUNIST EXPLOITATION OF
RADIATION "FALL-OUT" CONTROVERSY**

June 12, 1957



UNCLASSIFIED
CONFIDENTIAL

DECLASSIFIED WITH DELETIONS	
Agency Case	_____
NLE Case	<u>87-232nd 10</u>
By	<u>LHO</u> NLE Date <u>1/29/18</u>

UNCLASSIFIED
CONFIDENTIAL

I. INTRODUCTION

Communists throughout the world are exploiting the present public controversy concerning the hazards of radiation "fallout" from nuclear bomb tests. Since 1946, basic Soviet strategy has been directed at impeding and deterring the development of nuclear weapons in this country. The present efforts of communists to exploit the "fall-out" issue are in accordance with this basic strategy.

Much of the communist agitation on the "fall-out" issue stems from a communist front organization. In 1956, the World Federation of Scientific Workers (WFSW), an "international communist front," prepared and published a 40-page booklet entitled Unmeasured Hazards, which specifically discussed the harmful effects of radiation "fallout." The booklet was published in English, French, Russian, Chinese, German, and Japanese. It was distributed in the United States by the American Association of Scientific Workers (AASW), which maintains fraternal ties with the WFSW. It should also be noted that Dr. Linus Pauling, a focal point in the present "fall-out" controversy, has been one of the vice presidents of the AASW for several years.

The Communist Party, USA, is also actively exploiting the issue. On May 19, 1957, for instance, The Worker, weekend edition of the east coast communist newspaper, the Daily Worker, featured a special four-page supplement which emphasized the danger of excess radioactivity. Over 40,000 copies of this supplement have already been ordered by Party districts for distribution throughout the country. In addition, on May 27, 1957, Eugene Dennis, secretary of the Party's national affairs department, instructed all Party members to attempt to organize a nationwide campaign in protest over the continued testing of nuclear weapons. All Party districts were instructed to advise the Party's national headquarters of any action by municipal, county, or state bodies calling for a ban on nuclear weapons; any protests by local noncommunist organizations over the continued tests; any surveys to determine the presence of excess radioactive material in water supplies or dairy products; and any unfavorable editorial comment on statements by prominent individuals against the further testing of nuclear weapons. Dennis explained this information was necessary so the Daily Worker could afford this issue "major attention and emphasis."



On an individual basis, a number of persons with subversive affiliations have been featured prominently in this "fall-out" controversy in both the communist and noncommunist press.

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CONFIDENTIAL

A-389 Cont.2

TAYLOR

God bless you.

He extends his hand to Lucius, who takes it.

TAYLOR

Lucius.

LUCIUS

I think you're making a mistake.

TAYLOR

That's the boy. Keep 'em
flying.

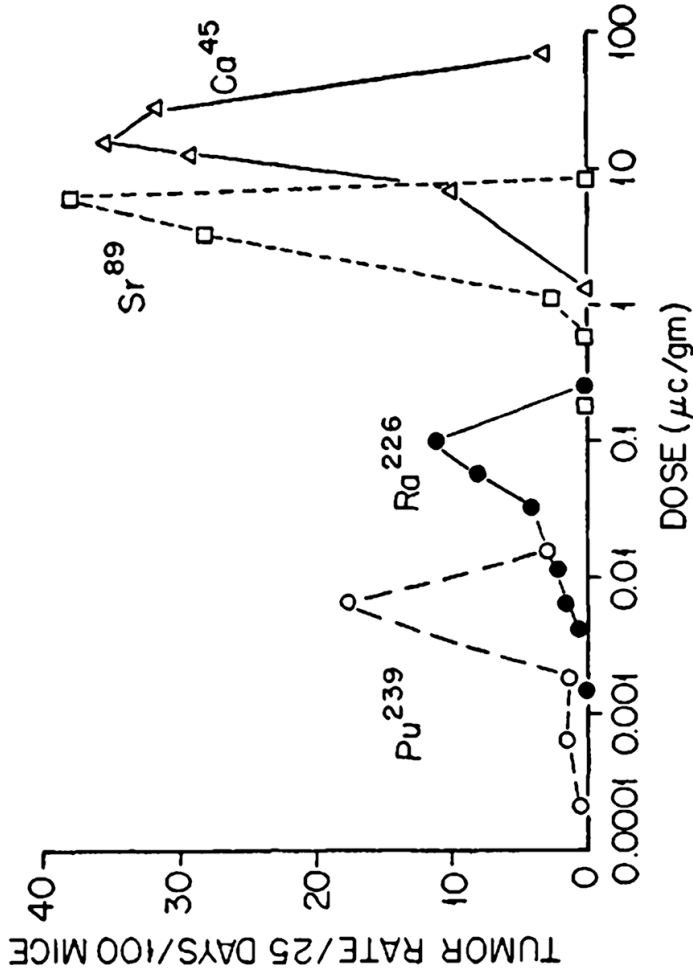
LUCIUS

What?

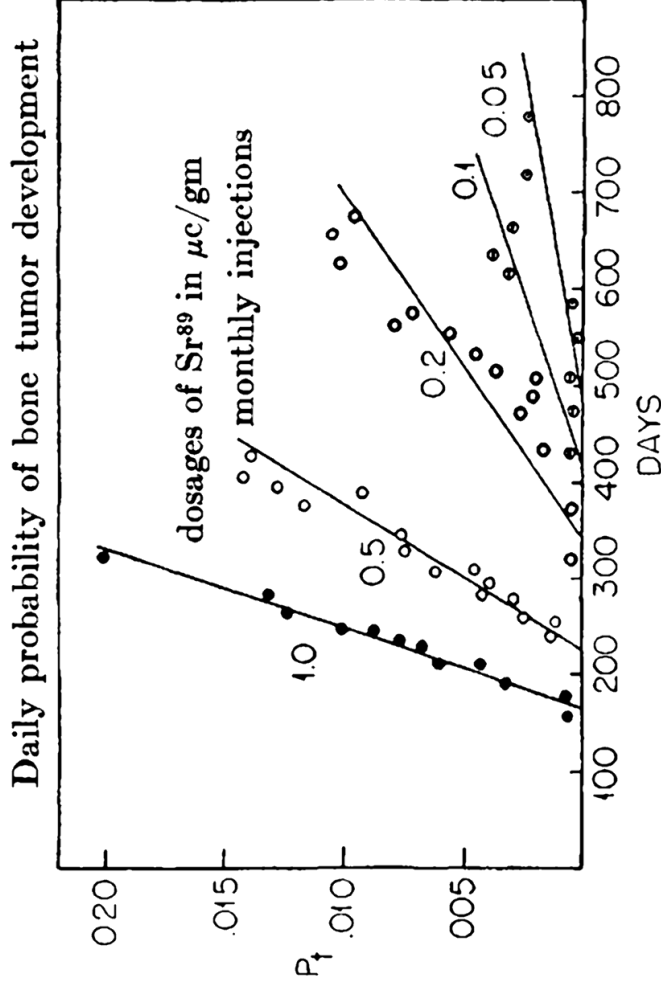
TAYLOR

The flags of discontent. It's
the only way anything ever gets
changed.

Threshold dose rate for bone cancer in mice

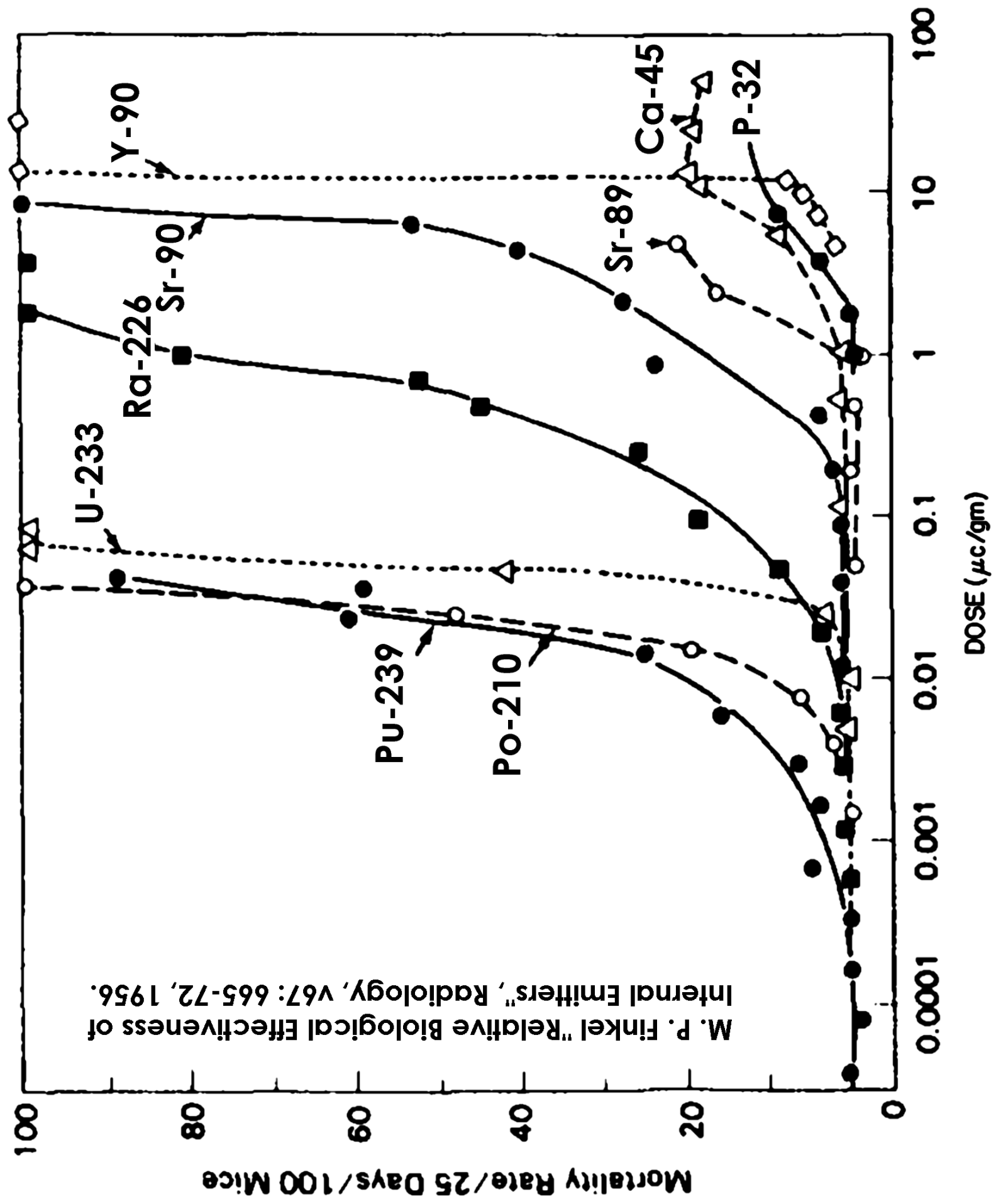


M. P. Finkel "Relative Biological Effectiveness of Internal Emitters", Radiology, v67: 665-72, 1956.



A. M. Brues, "Biological Hazards and Toxicity of Radioactive Isotopes", J. Clin. Investigation, v28, pp. 1286-96, 1949.

M. P. Finkel "Relative Biological Effectiveness of Internal Emitters", Radiology, v67: 665-72, 1956.



M. P. Finkel "Relative Biological Effectiveness of Internal Emitters", Radiology, v67: 665-72, 1956.

Bone Malignancies Rate/25 Days/100 Mice

DOSE ($\mu\text{c/gm}$)

Sr-90

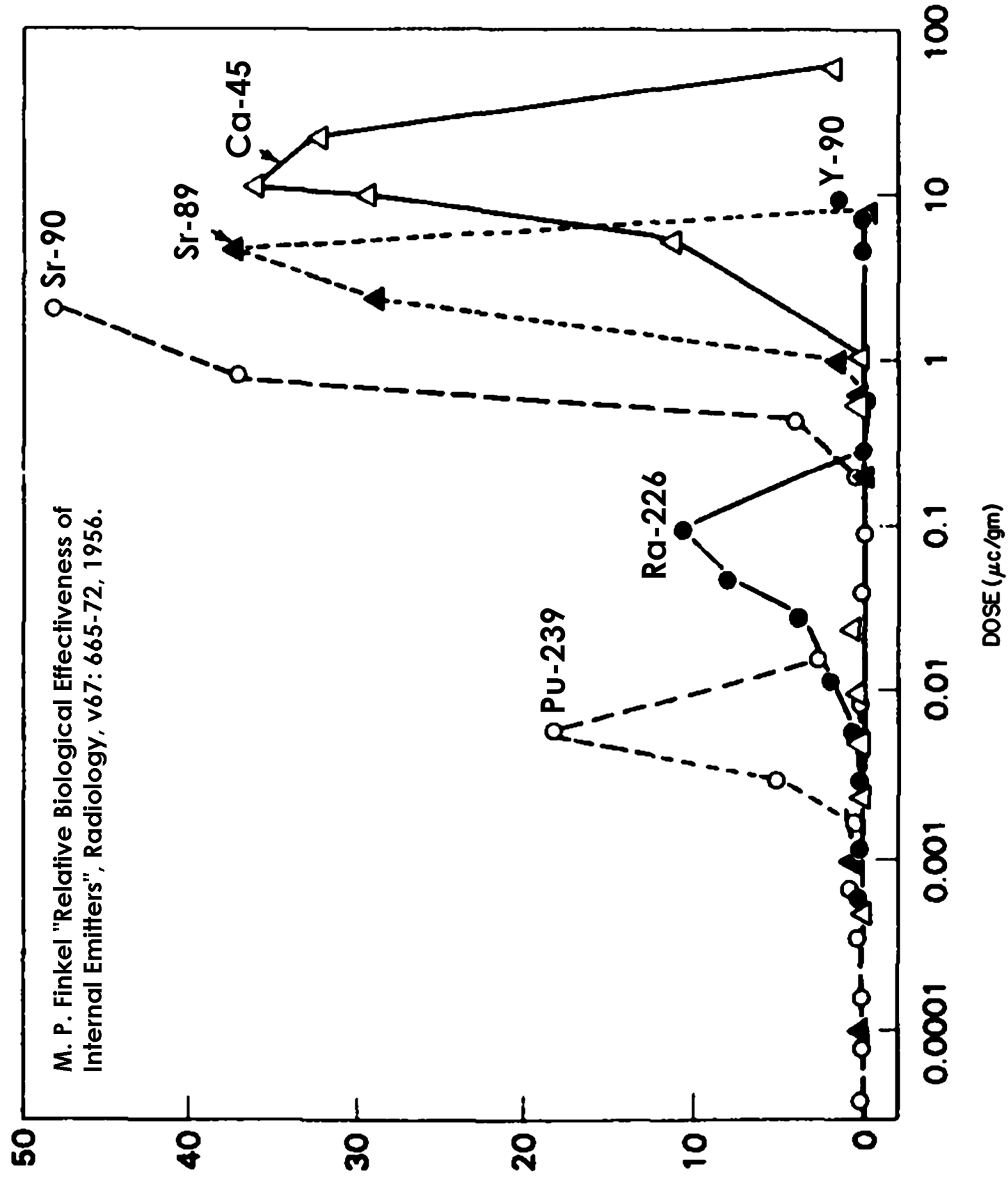
Sr-89

Ca-45

Ra-226

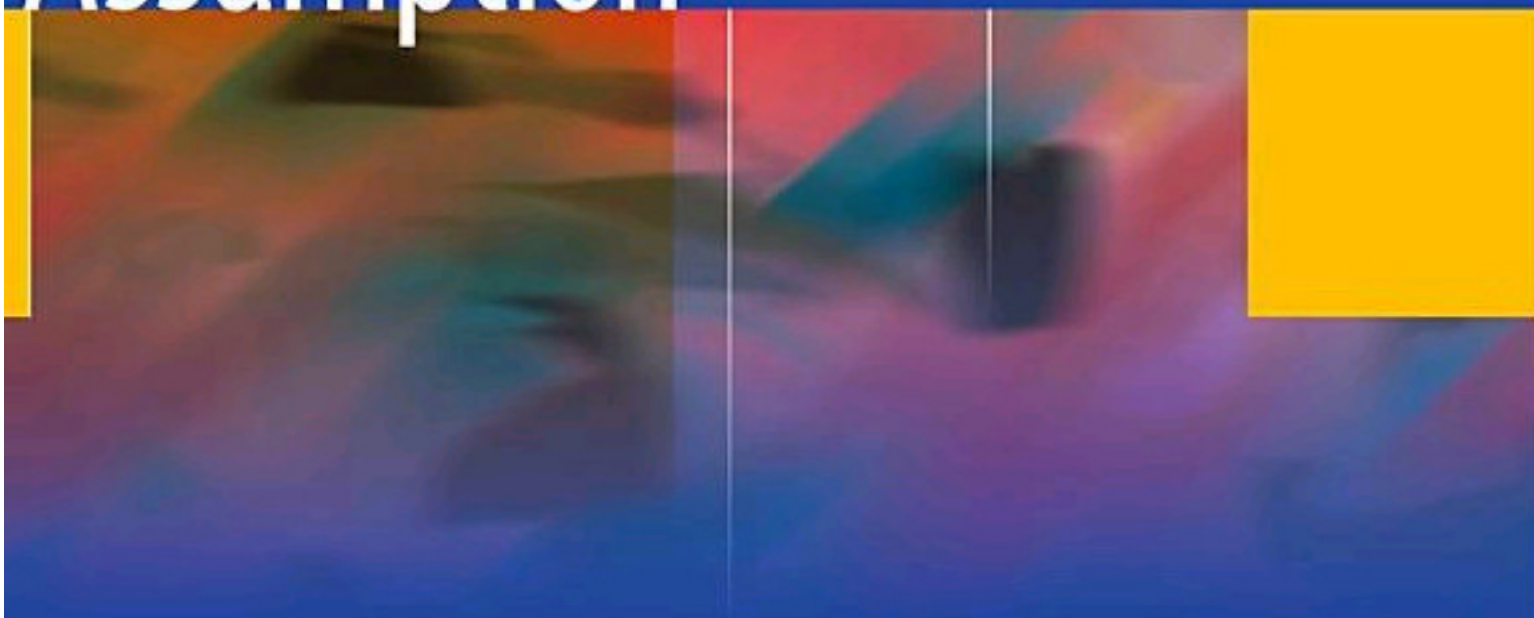
Pu-239

Y-90



Radiation Hormesis and the Linear-No-Threshold Assumption

Charles L. Sanders



Springer

THE NATURE OF RADIOACTIVE FALLOUT AND ITS EFFECTS ON MAN

HEARINGS

BEFORE THE
SPECIAL SUBCOMMITTEE ON RADIATION
OF THE
JOINT COMMITTEE ON ATOMIC ENERGY
CONGRESS OF THE UNITED STATES
EIGHTY-FIFTH CONGRESS
FIRST SESSION
ON
THE NATURE OF RADIOACTIVE FALLOUT AND
ITS EFFECTS ON MAN

MAY 27, 28, 29, AND JUNE 3, 1957

PART 1

Printed for the use of the Joint Committee on Atomic Energy



UNITED STATES
GOVERNMENT PRINTING OFFICE

Representative VAN ZANDT. Dr. Muller, in the December 3, 1956, issue of the Federation of American Scientists you are quoted as saying this:

It is reckless to increase the risk of war by continuing H-bomb tests. It is not the fallout from these tests that is at issue at this time but the war feeling. The first step for peace open to us is a discontinuance of tests by both sides. If breached by either side it can be detected by the other.

STATEMENT OF DR. W. L. RUSSELL, OAK RIDGE NATIONAL LABORATORY ⁵

Dr. RUSSELL. Mr. Chairman, members, the testimony to be given here is presented in response to one of the requests by this committee for scientific results on the biological effects of radiation caused by events other than fallout. Assuming the present estimates of radiation from fallout to be approximately correct, it would in fact be virtually impossible at the present time to measure the genetic effects of fallout in mammals. In estimating the genetic hazards of fallout, we are, therefore, forced into using the information obtained from experiments, such as those to be described, in which much higher levels of radiation were used.

⁵B. A., Oxford University, 1932; Sherman Pratt fellow, Amherst College, 1932-33; fellow, University of Chicago, 1933-34; assistant, department of zoology, University of Chicago, 1934-36; Ph. D., University of Chicago, 1937; research associate, Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine, 1937-47; principal geneticist, Oak Ridge National Laboratory, 1947 to present; research and publications on the genetic effects of radiation in mice. In charge of the Mammalian Genetics and Development Section of the Biology Division of Oak Ridge National Laboratory. Member of the United States delegation to the 1955 Geneva Conference on the Peaceful Uses of Atomic Energy. Member of the Committee on Genetics Effects of Atomic Radiation, National Academy of Sciences. (Submitted by witness.)

RADIOACTIVE FALLOUT AND ITS EFFECTS ON MAN 1087

Our present information on this point indicates that mouse genes are on the average approximately 15 times as sensitive to radiation as *Drosophila* genes. The earlier estimates of genetic hazards in man based on results in *Drosophila* have, therefore, been revised.

Another question on which information was badly needed was whether or not there is any recovery from genetic damage with time after irradiation. Some geneticists believed that there would be no such recovery. Others thought that some recovery might occur. Critical evidence on this point had not been obtained. Most of the information along these lines came from experiments with *Drosophila* sperm, whereas the evidence needed was for immature sex cells. Let me elaborate for a moment on the importance of the cell stage, i. e., immature versus mature germ cells, before we continue with the question of recovery.

1088 RADIOACTIVE FALLOUT AND ITS EFFECTS ON MAN

Representative HOLIFIELD. At that point, Dr. Russell, could you tell this committee how near you think the experiments on mice would correspond to the radiation of human beings? You have made the statement that the mouse is 15 times more sensitive than the fruitfly. Can you give us a comparison between the mice and the human being?

1090 RADIOACTIVE FALLOUT AND ITS EFFECTS ON MAN
ERROR BY RUSSELL: IGNORING DOSE RATE!

Dr. RUSSELL. This is all on mice.

I might also interject at this point another comment. A good deal has been said about there being no *Drosophila* data on mutation rates below 25 roentgens and about there being no mouse data below 300 roentgens. Yet, again referring to Dr. Oakberg's work in our laboratory, he can see ~~and actually measure~~ the killing of spermatogonial cells with doses as low as 2 or 3 roentgens, and even with 1 rep of neutrons. A dose of 22 roentgens kills half of the sensitive spermatogonia. So it seems to me that if we can actually see cells that have been killed by doses as low as 2 or 3 roentgens, and can put this on a quantitative basis, if cells are actually killed at these dose levels, there is no question in my mind that there will be genetic effects from doses as low as this.

Representative HOLMFELD. This has a tremendous impact on the theory of threshold, does it not?

Dr. RUSSELL. It certainly helps to answer the question of threshold for genetic effects. Of course, the question of threshold for some somatic effects is not answered by this, because killed cells might be replaced by normal cells. So it does not conclusively prove anything about the question of a threshold for somatic effects. I think it supports the already quite well established point of there being no threshold for genetic effects, because here is direct experimental evidence on mammals that cells can be killed measurably by doses as low as 2 or 3 roentgens. RUSSELL LATER FOUND DOSE RATE EFFECTS

JOINT COMMITTEE ON ATOMIC ENERGY

SUMMARY-ANALYSIS OF HEARINGS
MAY 27-29, AND JUNE 3-7, 1957

ON

THE NATURE OF RADIOACTIVE FALLOUT
AND ITS EFFECTS ON MAN



AUGUST 1957

Printed for the use of the Joint Committee on Atomic Energy

UNITED STATES
GOVERNMENT PRINTING OFFICE

GROUP THINK CONSENSUS IS NOT SCIENTIFIC FACT; DNA REPAIR IS IGNORED:

3. *Biological effects of radiation.*—There was general agreement that any amount of radiation, no matter how small the dose, increases the rate of genetic mutation (change) in a population. There was, on the other hand, a difference of opinion as to whether a very small dose of radiation would produce, similarly, an increased incidence of such somatic (nongenetic) conditions as leukemia or bone cancer, or a decrease in life expectancy, in a population.

4. *Tolerance limits.*—There was general agreement that there is a limit to the amount of radioactivity and, hence, to the amount of fission products that man can tolerate in his environment. The extent to which existing and future generations will be affected by manmade radiation was shown to be intimately tied to certain decisions, moral as well as scientific, that must be made as to how much radiation can be tolerated by the peoples of the world.

5. *Effects of past tests.*—It was clearly shown that man's exposure to fallout radiation including strontium 90 is and will be in general small, *for the testing already done*, compared with his exposure to other, "normal background" sources of radiation (a fraction of 1 to 10 per cent), and even compared with variations in "normal background" sources. But it was not agreed on how this information should be interpreted.

SCIENCE FACTS ARE DETERMINED BY EXPERIMENT, NOT CONSENSUS

There were two bases given for saying that the increase of the incidence in genetic effects of radiation is proportional to dose. The first uses experimental data. All of these data is obtained at doses considerably above background levels. The second is theoretical and holds that the mechanism of genetic damage is damage to the genetic material of each individual cell. The idea of a direct proportion between increase in incidence of genetic effects and dose appears to be accepted widely among scientists. Furthermore, geneticists believe that the direct proportion applies down to zero dose—that is, that there exists no safe “threshold” below which the dose produces no damage, and that damage occurs from any irradiation of the genetic cells, no matter how small the dose.

FALSE! IGNORES DNA REPAIR

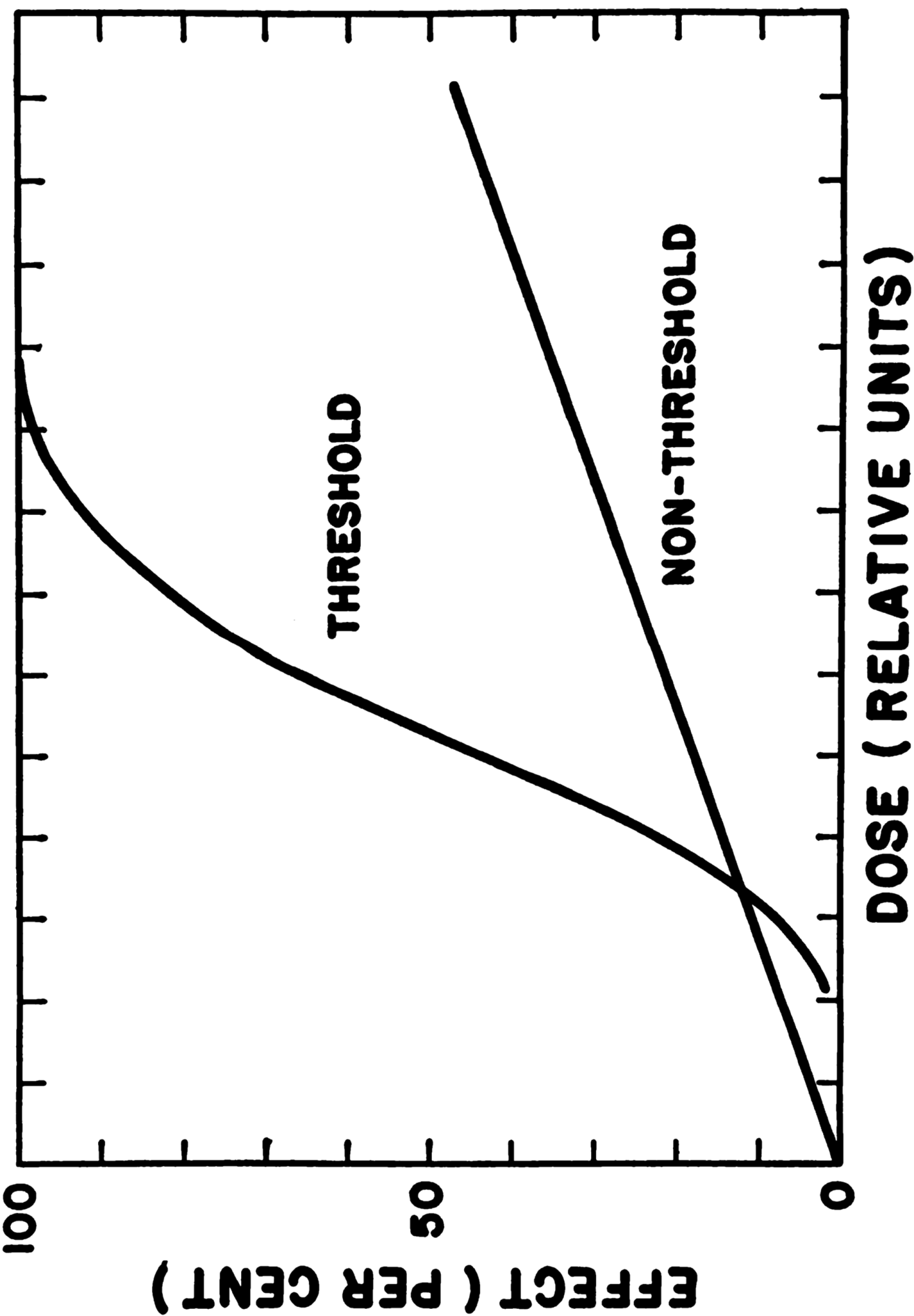


FIGURE 3.—A pictorial representation of the difference between a threshold and a nonthreshold situation. Dose increases to the right. Note that the non-threshold line is a straight line; it needn't be. (See p. 15.) [Figure reprinted from testimony of Drs. Latham and Anderson, Los Alamos Scientific Laboratory.]

Radiation genetics surprise

IT has long been one of the basic axioms of radiation genetics that the genetic mutation rate due to radiation is independent of the radiation intensity, or dose-rate, and depends only on the total integrated dose.

Recent experiments reported by Russell *et al.* (*Science*, 128, 1546) have shown that most of the difference in the observed mutation rates is indeed due to variation in the radiation intensity.

If the dose rate is significant for humans, then the genetic effect of the natural background of radiation will be much less important than that due to medical X-rays.

- Russell, W. L. (1956b). Lack of linearity between mutation rate and dose for x-ray-induced mutations in mice. *Genetics* **41**, 658-659.
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- Russell, W. L. (1964a). Effect of radiation dose fractionation on mutation frequency in mouse spermatogonia. *Genetics* **50**, 282.
- Russell, W. L. (1964b). Evidence from mice concerning the nature of the mutation process. *Genet. Today, Proc. Int. Congr., 11th, The Hague, 1963* **2**, 257-264.
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- Russell, W. L., and Russell, L. B. (1959a). Radiation-induced genetic damage in mice. *Prog. Nucl. Energy, Ser. 6* **2**, 179-188.
- Russell, W. L., and Russell, L. B. (1959b). The genetic and phenotypic characteristics of radiation-induced mutations in mice. *Radiat. Res., Suppl.* **1**, 296-305.

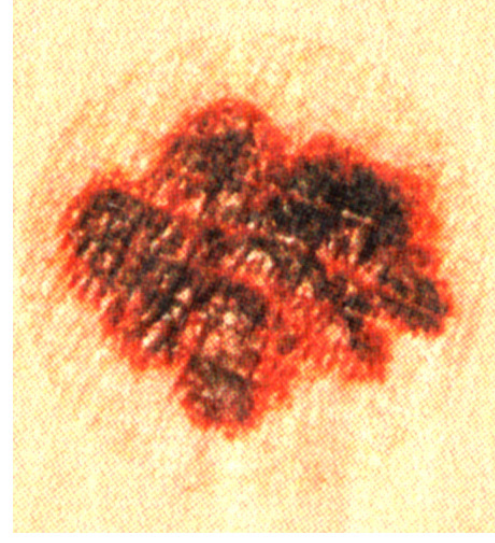
SKIN CANCER RESULTS FROM HIGH DOSE RATE



Basal
(rounded
lump with
unhealed
sore)



Squamous Melanoma
(crusty with
inflamed
base) mole)



Lifetime risk of skin cancer:

4%

1%

0.8%

Proportion of skin cancer:

68%

18%

14%

The coming of reversibility: The discovery of DNA repair between the atomic age and the information age

Doogab Yi

**Historical Studies in the Physical and Biological Sciences
Vol. 37, No. supplement (Supplement (2007)), pp. 35-72**

ON DECEMBER 18, 1956, Prescott Bush, U.S. Senator from Connecticut, had a conversation with the members of the Department of Biophysics at Yale University, in which he asked about the radiation hazards of nuclear weapons testing. The following month, the Yale biophysicists sent a formal reply to the Senator, expressing their reservations concerning the tests.¹ Their opposition stemmed from their understanding of the biological effects of radiation: First of all, they pointed out that genetic damages inflicted by radiation were “not reversible”; second, current knowledge about the effects

***Program in History of Science, 128 Dickinson Hall, Princeton University, Princeton, NJ 08544-1017; yi@princeton.edu.**

I thank Angela Creager and Michael Gordin for their guidance, help, and insightful comments on earlier versions of my research paper for their course “Radioactive Sciences.” A graduate seminar on “Computers and Organisms” offered by Angela Creager and Michael Mahoney pointed me to the traffic between computer science and biology. I appreciate the generosity and helpful suggestions of Richard Setlow, Harold Morowitz, and William Summers, especially their first-hand recollections and suggestions for my research. Those in attendance at the presentation of this paper at the annual meeting of the History of Science Society in 2005, especially Jacob Hamblin, Joseph November, and Buhm Soon Park, asked useful questions and offered valuable suggestions for its revision. I thank Dan Bouk for his editorial help, and I especially appreciate useful suggestions from *HSPS* referees. Research for this project was assisted by a grant-in-aid from the Center for the History of Physics at the American Institute of Physics. I remain responsible for any errors in this paper.

The following abbreviations are used: AEC, United States Atomic Energy Commission; *JHB*, *Journal of the history of biology*; NARA, National Archives and Records Administration in Washington, D.C. and College Park, MD; NBL/AIP, Niels Bohr Library at the American Institute of Physics; NBS, National Bureau of Standards; NIH, National Institutes of Health; and ORNL, Oak Ridge National Laboratory, College Park, MD; *PNAS*, National Academy of Sciences, *Proceedings*.

1. Ernest C. Pollard, Richard B. Setlow, Franklin Hutchinson, Walter R. Guild, and Harold J. Morowitz to Senator Prescott Bush, 21 Jan 1957, folder, Medicine, Health, and Safety, Box 47, Record Group 362, NARA.

DNA REPAIR

BY PAUL HOWARD-FLANDERS

*Department of Molecular Biophysics and Radiobiology Laboratories,
Yale University, New Haven, Connecticut*

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INTRODUCTION

Cells from various organisms contain enzyme systems for joining DNA chains and maintaining the integrity and high molecular weight of cellular

IS THERE A LARGE RISK OF RADIATION? A CRITICAL REVIEW OF PESSIMISTIC CLAIMS*

Adnan Shihab-Eldin**

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Alexander Shlyakhter and Richard Wilson

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A number of situations where it has been claimed that moderate radiation doses cause leukemia or other cancers are carefully reviewed. We look at cases in the United States and Great Britain. Usually, it can be demonstrated that there is an alternative, more probable, explanation for the effect seen. In several cases, the authors of the papers have fallen into statistical traps. The most frequent is a *posteriori* selection of cohort boundaries in both space and time: a trap illustrated dramatically by Feynman. The next most common trap is to arbitrarily select one out of many ways of looking at the data, against which we were warned by Tippet. Several cohorts are compared with respect to the number of persons at risk, average dose, and the number of cancers expected. Of these, only the cohort of A-bomb survivors in Japan provides evidence of clearly visible excess cancers.

STATISTICAL TRAPS

The late Richard Feynman had a dramatic way of demonstrating that a biased selection of data can invalidate standard statistical tests. Coming into class, he said, "You know, the most amazing thing happened to me tonight. I was coming here, on the way to the lecture, and I came in through the parking lot. And you won't believe what happened. I saw a car with the license plate ARW 3571 Can you imagine? Of all the millions of license plates in the state, what was the chance that I would see that particular one tonight?" (Goodstein 1989).

Ernest Sternglass published a paper (Sternglass 1963) alleging a link between fallout from nuclear bomb tests and the infant mortality rate.

It was tempting at the time for scientists to believe Sternglass' claims without looking carefully at them. By 1963, a majority of scientists had successfully persuaded the major countries of the world to stop testing of nuclear bombs in the atmosphere.

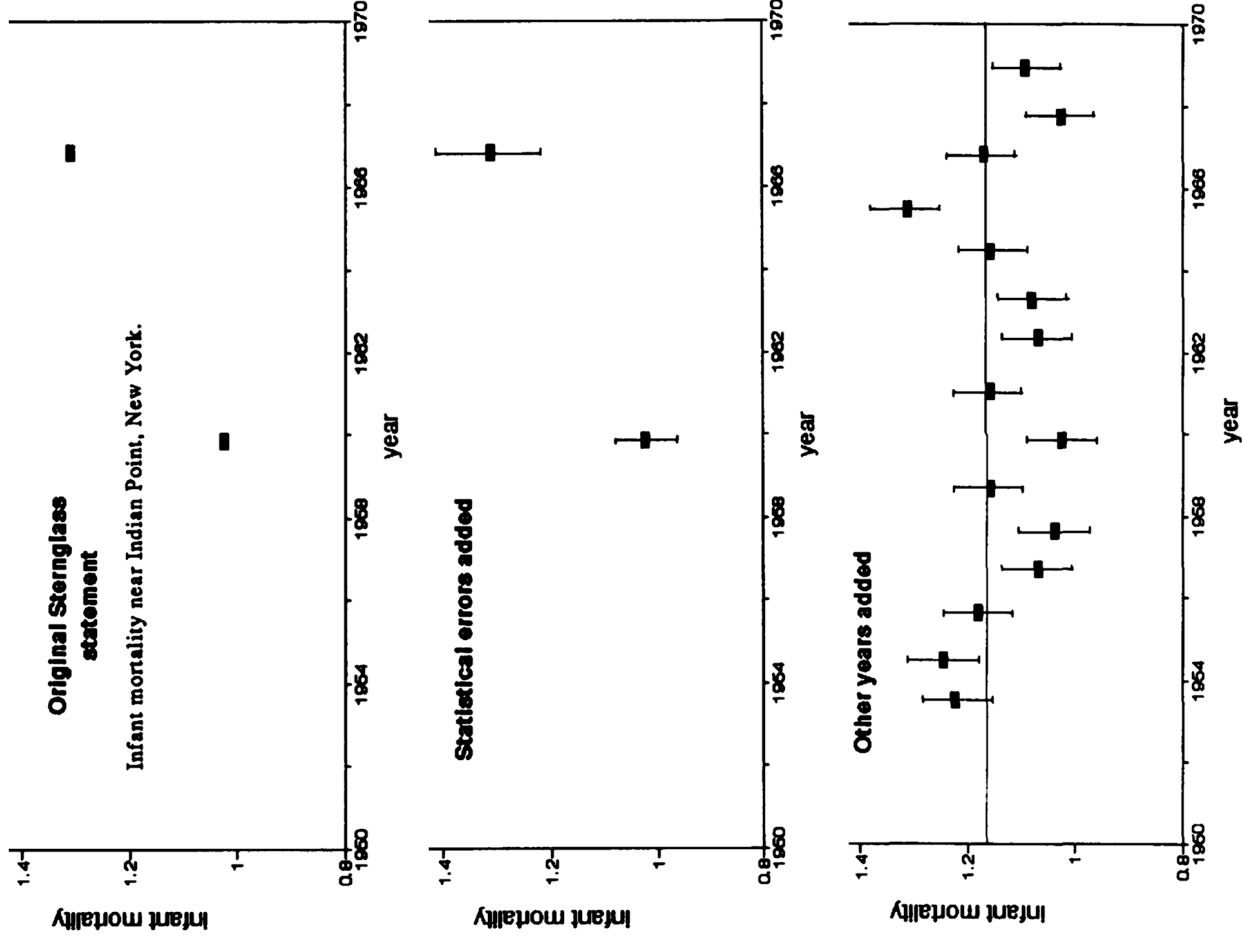
Stewart, A. The pitfalls of extrapolation. New Sci. July 24, 1969.

Tippet, L.H.C. The methods of statistics. An introduction mainly for experimentalists. London: Williams and Norgate, Ltd.; 1937.

Sternglass, E.J. Cancer, relation of prenatal radiation to development of the disease in childhood. Science 140:1102-04; 1963.

Sternglass' claims met with a storm of criticism (Graham and Thro 1969; Boffey 1969; Stewart 1969; Wrenn 1969; Sagan 1969; Eisenbud et al. 1969; Heller 1970).

An example of one of these is his claim that infant mortality increased near Indian Point I Nuclear Power Plant just after it began operation in 1961.



"A Tragedy of Misunderstanding: there was no major radiation disaster at Fukushima"

**An invited talk at the Annual Meeting of the American Nuclear Society,
Chicago, 25 June 2012**

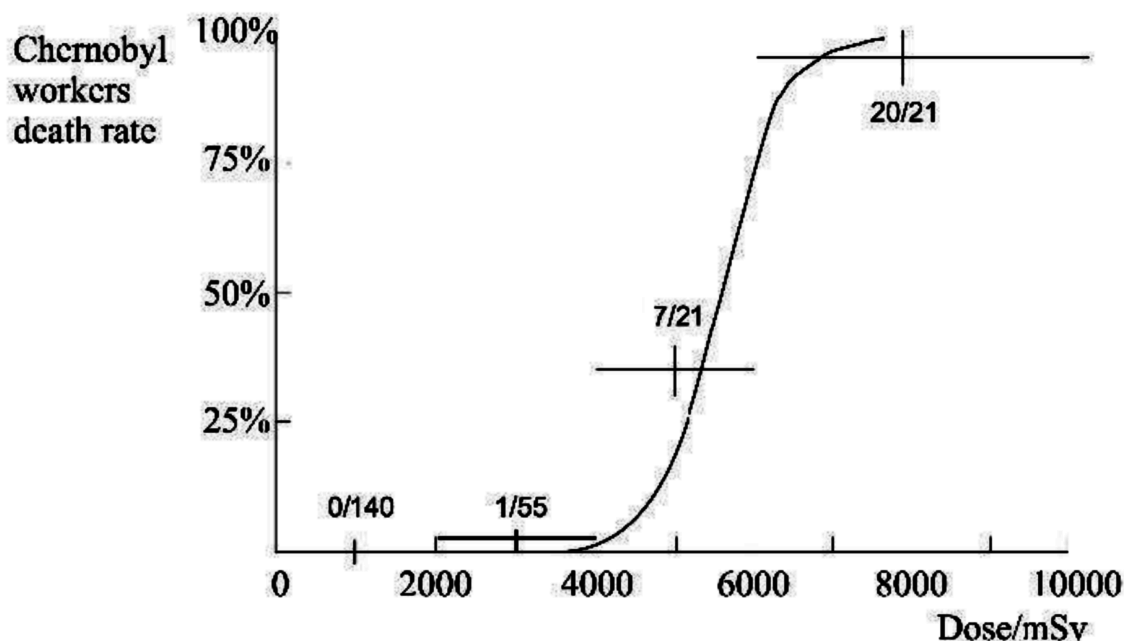
by Wade Allison, Emeritus Professor of Physics at the University of Oxford, UK

Summary

Low or moderate radiation doses are benign but the public health effects of fear and panic, caused by ignorance and over-cautious international "safety" standards, are dangerous, both to individuals and to the society and economy at large. A disaster of fear, not radiation, occurred at Fukushima as a result of the damage to the nuclear plant.

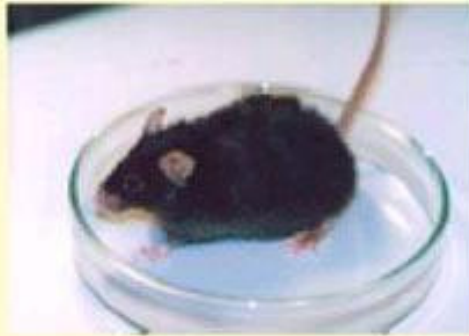
When the earthquake struck there were 500,000 people in the region subsequently inundated by the tsunami and within 26 to 45 minutes, all except 18,880 had managed to escape, a truly remarkable achievement. The training and understanding of the Japanese people that was evident for the tsunami was absent for the release of radiation and radioactivity. Faced by an unknown threat, nobody knew what action to take, and few in authority knew either, so that rumour and panic, extending to the highest levels, lead to serious social harm, widespread voluntary evacuation, failed businesses and losses of confidence in society and nuclear power. This failure of society to cope with an accident, for which no loss of life should be expected, is strange. Fear of powerful energy is a protective animal reaction, but man has survived dangers through study, understanding and mutual organisation -- although not in the case of radiation and radioactivity. Why not?

Cell death from an acute dose. Figure 4 refers to the 237 initial firefighters at Chernobyl who received high doses in a short period. Within a few weeks 28 were dead from ARS. Further deaths since then were probably not related to radiation. The crosses on the figure follow a typical stabilisation curve with a threshold of 2000 to 4000 mSv. The curve shows similar data for laboratory rats.



Appearance of *db/db* Mice at 90 Weeks of Age

Irradiated

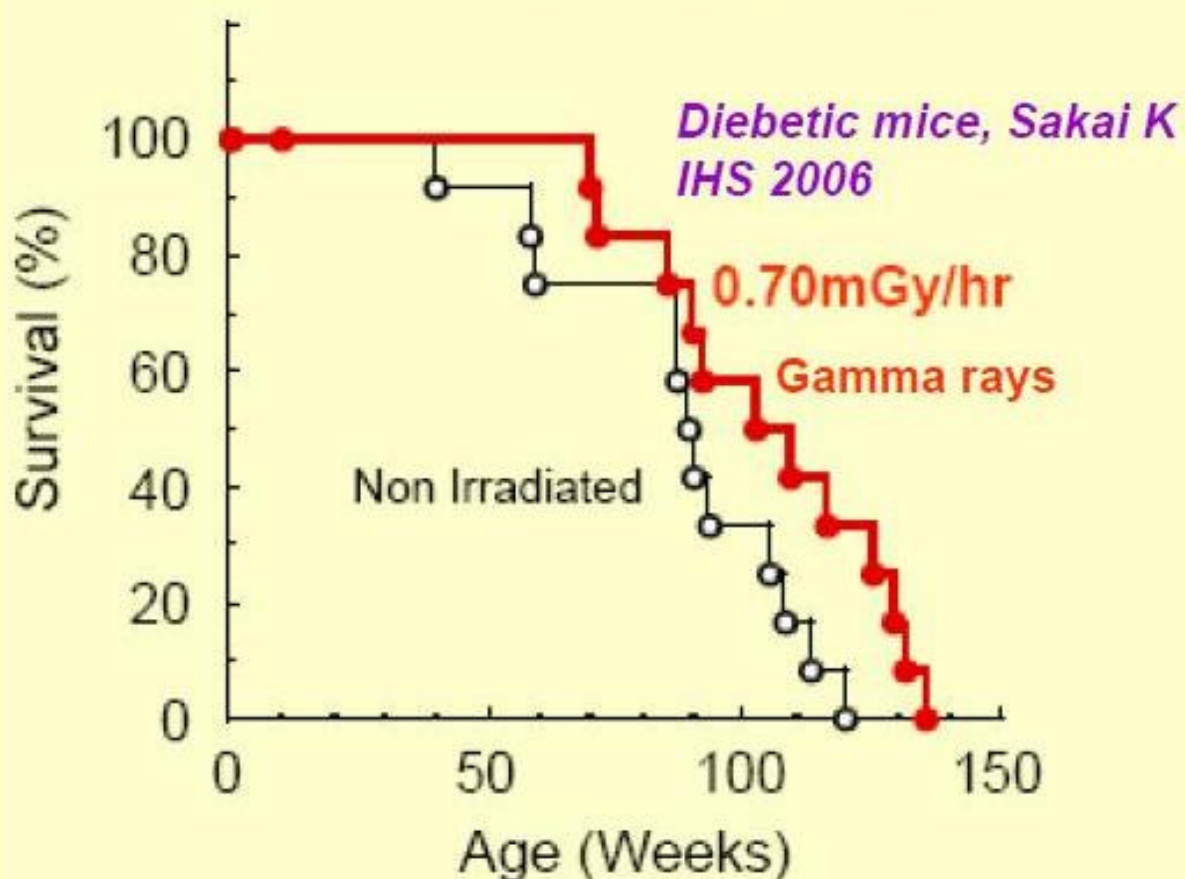


Non-Irradiated



Sakai K, IHS 2006

Prolongation of Life Span of *db/db* Mice by Low Dose Rate Irradiation



Survival of Food Crops and Livestock in the Event of Nuclear War

Proceedings of a symposium held at
Brookhaven National Laboratory
Upton, Long Island, New York
September 15–18, 1970

Sponsored by
Office of Civil Defense
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Editors

David W. Bensen
Office of Civil Defense
Arnold H. Sparrow
Brookhaven National Laboratory

December 1971

THE SIGNIFICANCE OF LONG-LIVED NUCLIDES AFTER A NUCLEAR WAR

R. SCOTT RUSSELL, B. O. BARTLETT, and R. S. BRUCE

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ABSTRACT

The radiation doses from the long-lived nuclides ^{90}Sr and ^{137}Cs , to which the surviving population might be exposed after a nuclear war, are considered using a new evaluation of the transfer of ^{90}Sr into food chains.

As an example, it is estimated that, in an area where the initial deposit of near-in fallout delivered 100 R/hr at 1 hr and there was subsequent worldwide fallout from 5000 Mt of fission, the dose commitment would be about 2 rads to the bone marrow of the population and 1 rad to the whole body. Worldwide fallout would be responsible for the major part of these doses.

It is now widely recognized that long-lived fission products would make a negligible contribution to the radiation exposure of the population in heavily contaminated areas shortly after a nuclear attack. The external radiation dose would usually be dominant, and, if simple precautions were taken to avoid the superficial contamination of foodstuffs, the entry of ^{131}I into milk would cause the only important problem of dietary contamination. Thus, for example, infants probably would not receive doses of more than 0.1 rad to bone marrow from ^{90}Sr nor more than 0.01 rad from ^{137}Cs in the weeks after a nuclear attack if they were fed continuously with milk produced in an area where the external dose rate at 1 hr after detonation had been 100 R/hr. Doses to the thyroid from ^{131}I might, however, exceed 200 rads.

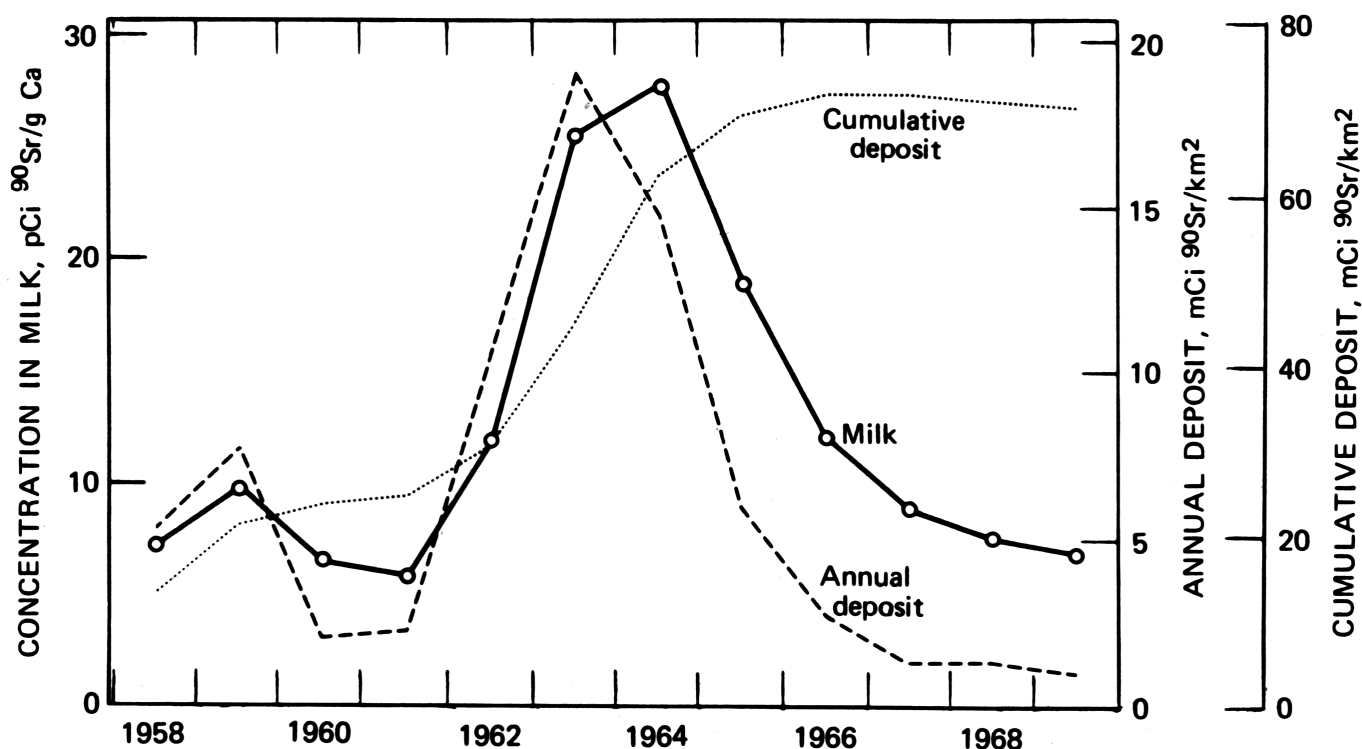


Fig. 1 Strontium-90 in fallout and milk in the United Kingdom, 1958 to 1969.

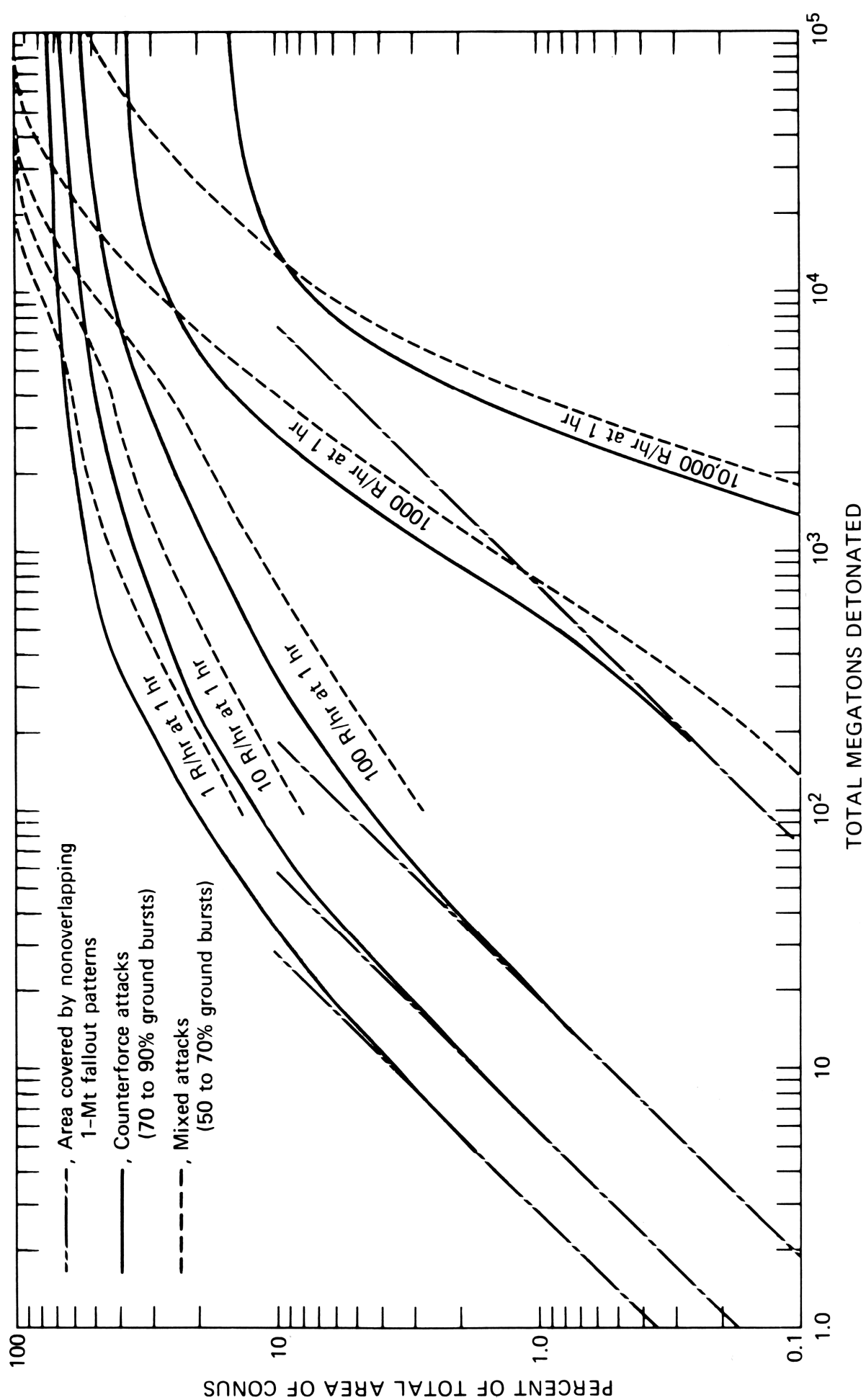
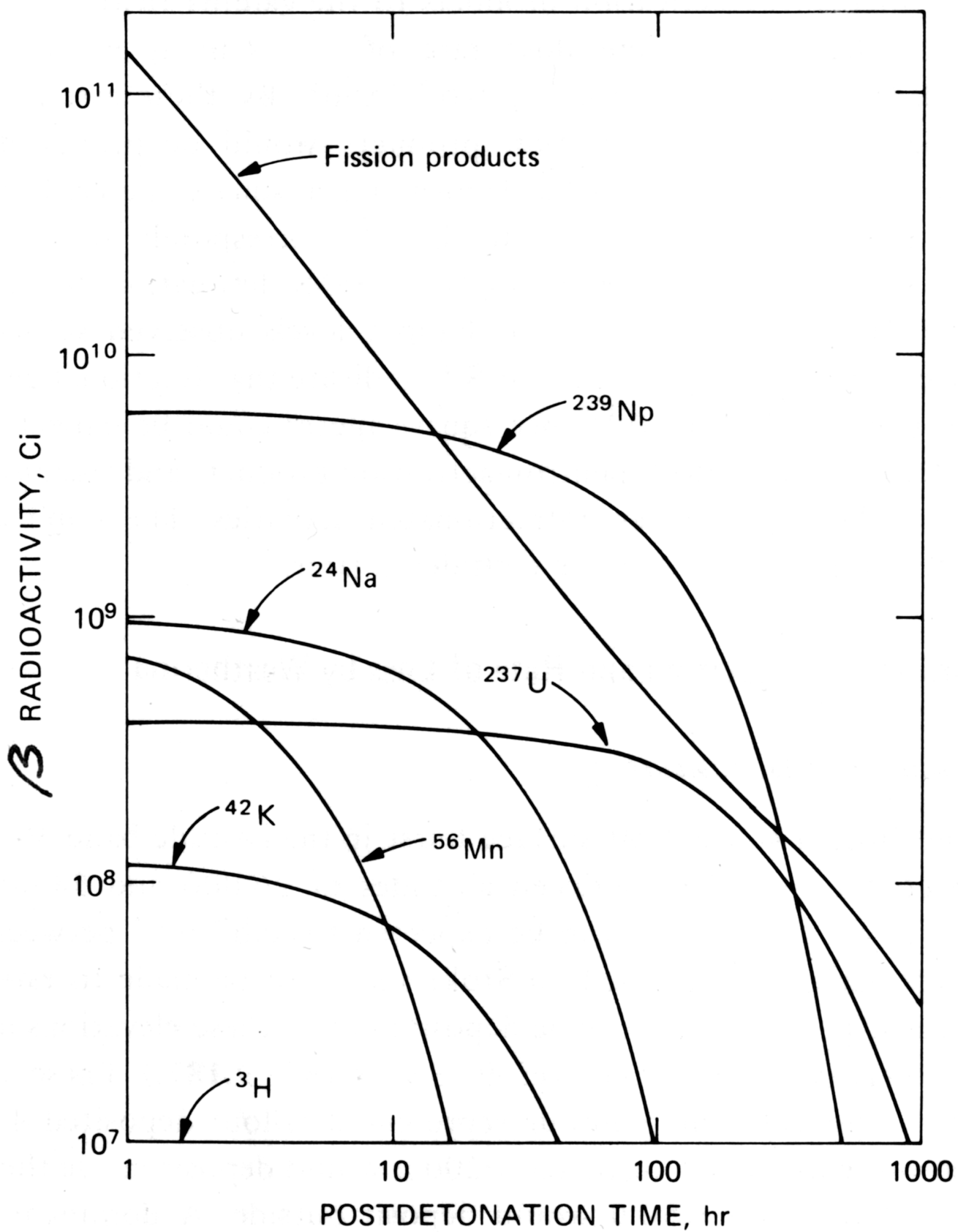


Fig. 1 Percent of area of the continental United States enclosed within selected I_5 contours as a function of attack weight (50% fission weapons).



Radioactivity from 1-Mt explosive with a fission-to-fusion ratio of 1.0.

SURVIVAL AND YIELD OF CROP PLANTS FOLLOWING BETA IRRADIATION

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Department of Soils and Plant Nutrition, University of California, Berkeley, California

ABSTRACT

Field experiments were carried out to investigate the effect of beta radiation on the growth of wheat, lettuce, and corn. The beta-radiation exposure was accomplished by fusing ^{90}Y onto 88- to 175- μ silica sand, and applying the sand to the crops with a remote-control applicator. Treatment levels on the wheat and lettuce crops ranged up to 59.4 mCi of ^{90}Y per square foot. In the corn experiment the highest level was 71.3 mCi of ^{90}Y per square foot. Wheat grain production was severely reduced when 6.6 mCi/sq ft of ^{90}Y was applied. This corresponds to approximately 2700 rads at the surface of the plant near the apical meristem. Lettuce yields were reduced significantly only at the highest treatment level, 59.4 mCi/sq ft, which corresponds to 9300 rads at the plant surface near the apical meristem. Some abnormalities could be seen on the lettuce at the 6.6 mCi/sq ft treatment level. Corn yield was not reduced and plant appearance was not changed in any of the treatments. The apical meristem of the corn plant was protected by about 1 cm of tissue, and it hence received very little ionizing radiation.

In the event of nuclear war, standing crops would be exposed to ionizing radiation from fallout containing both beta and gamma radiation in generally similar amounts. The study reported here is an investigation of the possible effects from the beta component.

Extensive literature exists on the effects of gamma radiation on plants in contrast to the very limited information available concerning the effects of beta exposure to plants.

It is widely accepted that the relative biological effectiveness (RBE) of beta to gamma doses is essentially unity¹ in the moderate and high beta energies found in fallout resulting from a nuclear detonation. This means that, when given ergs of energy are transferred to a fixed amount of tissue, deleterious effects will be the same whether the ionizing radiation is beta or gamma. In spite of this consideration, few predictions can be made of beta damage from gamma data, because of geometrical effects.

RADIATION DOSES TO VEGETATION FROM CLOSE-IN FALLOUT AT PROJECT SCHOONER

W. A. RHOADS,* H. L. RAGSDALE,† R. B. PLATT,† and E. M. ROMNEY‡

*EG&G, Inc., Santa Barbara Division, Goleta, California;

†Emory University, Atlanta, Georgia; and ‡University of California,

Laboratory of Nuclear Medicine and Radiation Biology, Los Angeles, California

Polyethylene sheets 6 m square and 6 mils thick were spread over as many *Artemisia* shrubs as could be covered conveniently at alternate stations along the arc.

The decrease to 52.6% in shrub doses is attributed to "self-shielding," which can be envisioned in terms of the masses of vegetation shadowing themselves. Shrubs that were protected from the direct fallout contamination showed even larger reductions in beta doses, however. For the stations shown in Table 1, the covered shrubs received only 31.2% of the beta dose at 25 cm in the open and away from shrubs.

Table 1

DOSE ACROSS THE MAIN FALLOUT PATTERN AT 25 CM
ABOVE THE SOIL SURFACE AND TO SHRUBS

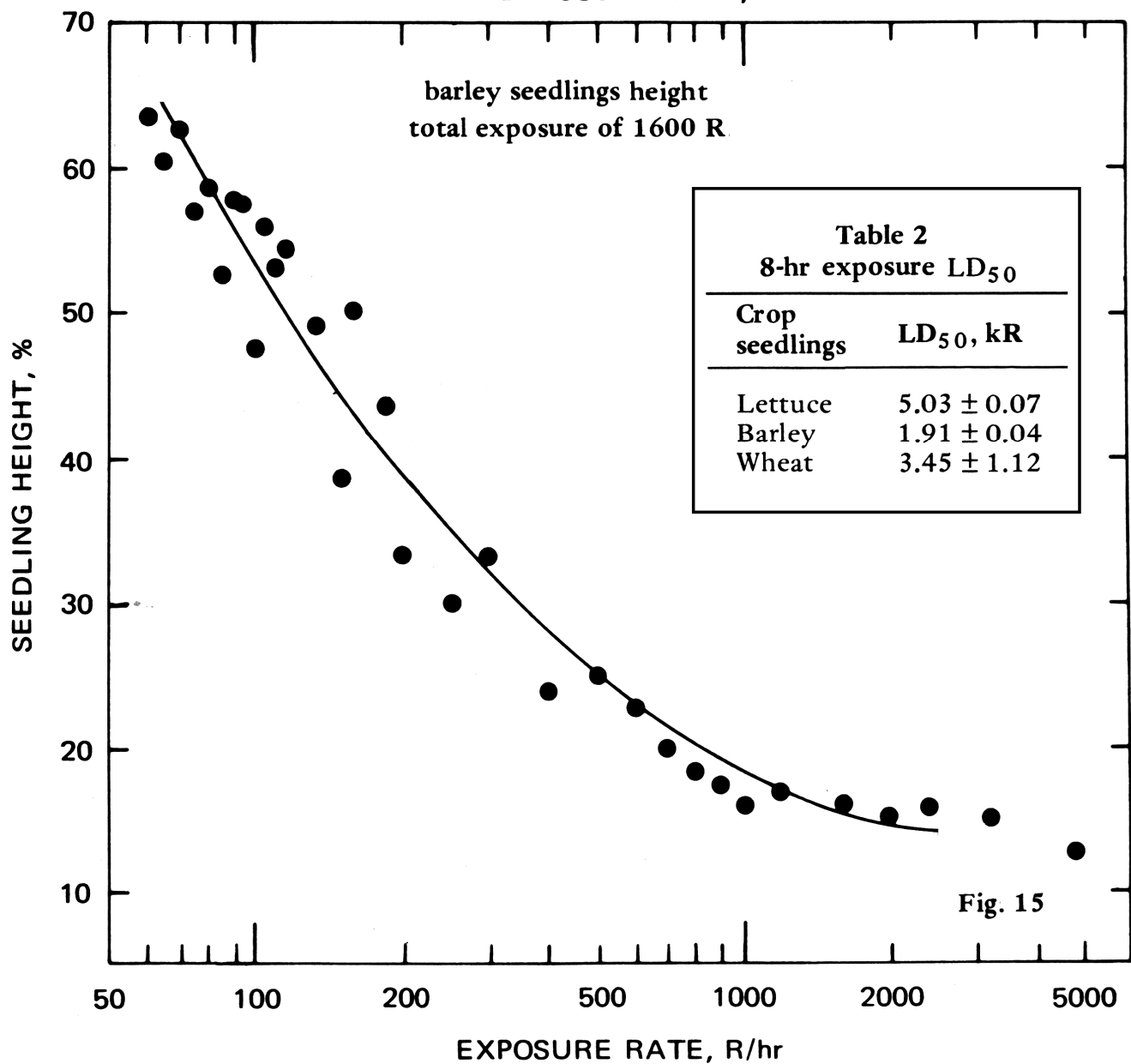
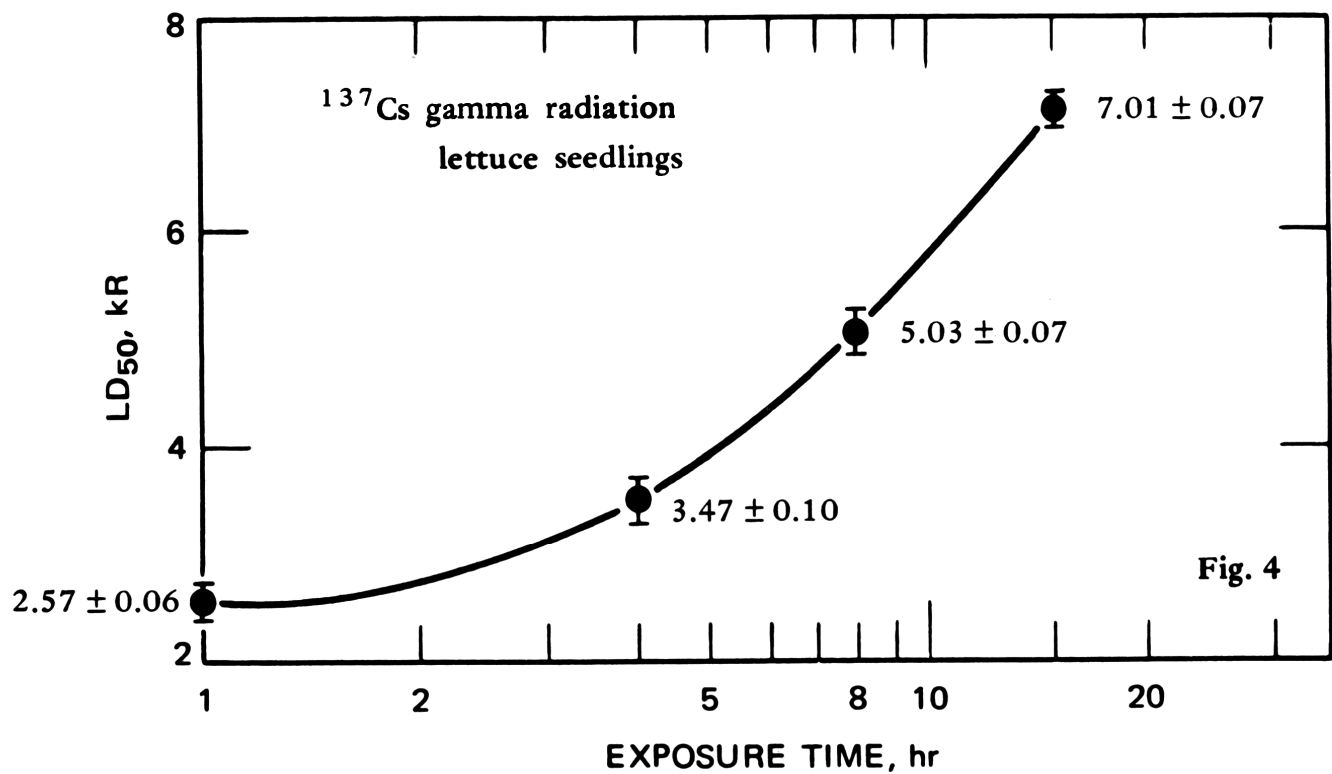
Station No.	Gamma-ray dose, rads			Beta-ray dose, rads		
	Dose at 25 cm	Shrub		Dose at 25 cm	Shrub	
		Open*	Covered		Open	Covered
12N	280		255	2100	1110	630
10N	380	420	350	3420	2160	1590
8N	800	810	770	7800	3000	2190
6N	950	1060	800	10650	5250	3000
4N	820		710	8640	4140	3270
2N	700	640	610	8100	3900	2100
0	650	680	470	7050	3000	2340
2	800	750	660	7500	2910	1770
4	650	660	480	5550	2250	1650
6	600	590	600	4650	2340	1650
8	720	700	600	5040	3240	2040
10	800	850	530	5400	3600	1560
12	620	580	550	4450	2190	900
14	440		370	3480	1620	900
16	300	‡	260		1650	570
18	200	210	200	2100	1500	540
20	130	120	80	1410	990	570

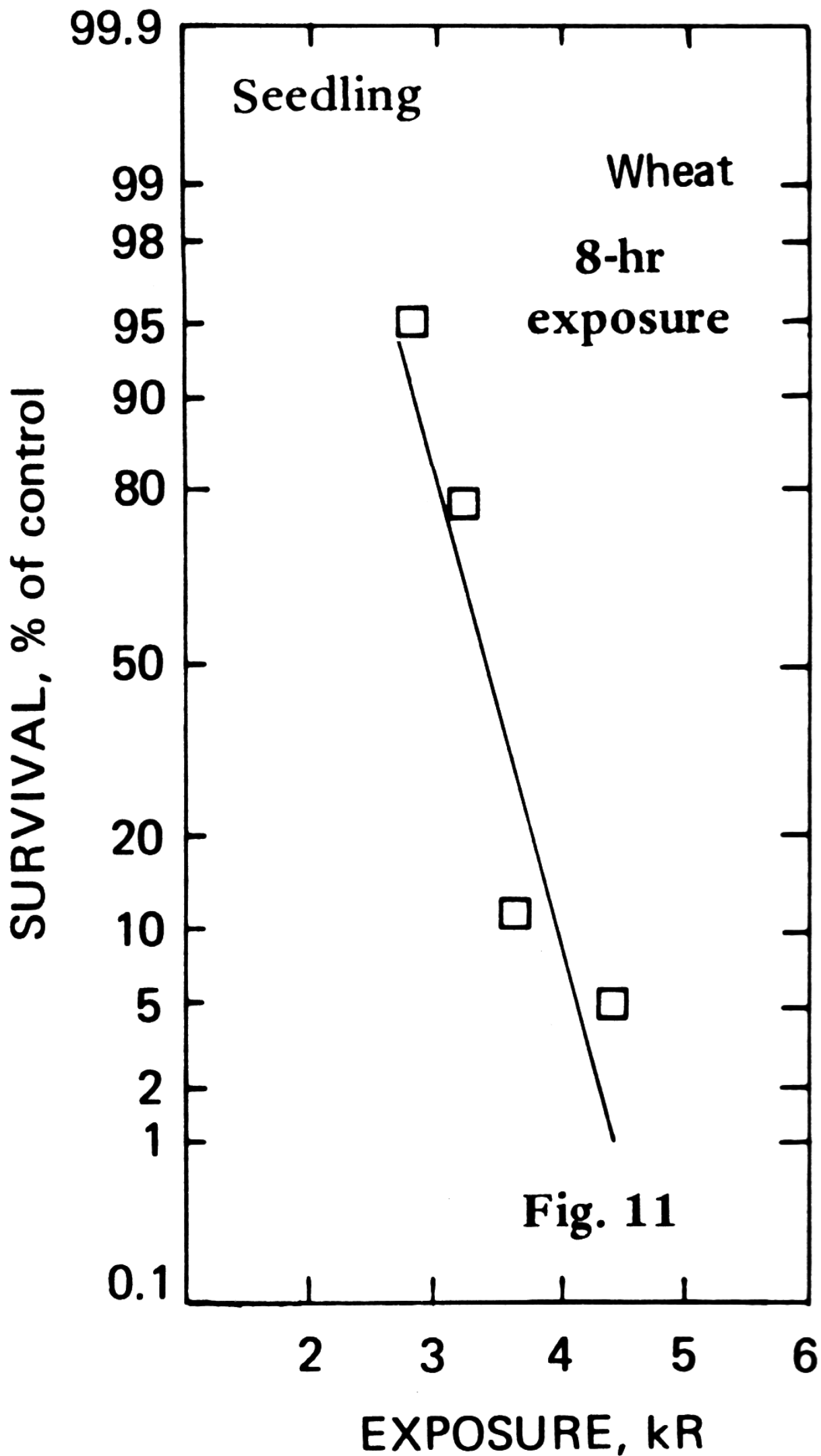
Percent of 25-cm dose 52.6
±10.9 31.2
±6.9

EFFECTS OF EXPOSURE TIME AND RATE

P. J. BOTTINO and A. H. SPARROW

Brookhaven National Laboratory, Upton, New York





THE EFFECTS OF EXTERNAL GAMMA RADIATION FROM RADIOACTIVE FALLOUT ON PLANTS, WITH SPECIAL REFERENCE TO CROP PRODUCTION

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Brookhaven National Laboratory, Upton, New York

Table 11

MISCELLANEOUS FRUITS AND VEGETABLES

Plant	Yield Reduction from unirradiated control		
	YD ₁₀ or LD ₁₀ ± S.D., R	YD ₅₀ or LD ₅₀ ± S.D., R	YD ₉₀ or LD ₉₀ ± S.D., R
Strawberry, 'Takane' Stolon 17 R/min	1,330 ± 650	6,530 ± 1860	20,800 ± 7300
Tomato, 'Rutgers' Seedling 16-hr exposure	10,100 ± 480	12,100 ± 290	17,600 ± 800

Table 12

PASTURE AND FORAGE CROPS 30 R/min 7-week seedling

Plant	Yield Reduction from unirradiated control		
	YD ₁₀ or LD ₁₀ ± S.D., R	YD ₅₀ or LD ₅₀ ± S.D., R	YD ₉₀ or LD ₉₀ ± S.D., R
Meadow fescue	1,500 ± 1070	2,480 ± 930	5,150 ± 1070
White clover	6,450 ± 370	23,400 ± 970	69,900± ± 3930

*Communicated by R. S. Russell, Agricultural Research Council, Letcombe Laboratory, England, 1970.

THE IMPORTANCE OF TRITIUM IN THE CIVIL-DEFENSE CONTEXT

pp. 71-80

Table 3 shows that the internal tritium
dose rate at 2 weeks after burst is 10,000
times less than the external
gamma

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Lawrence Radiation Laboratory, Bio-Medical Division, University of California,
Livermore, California

ABSTRACT

The importance of tritium in the civil-defense context is assessed by comparing the dose rate and the 30-year dose integral for tritium from fusion with the external dose of gamma-emitting fission products.

The tritium dose is computed by assuming equilibration of fallout tritium with water in the biosphere and with the body water of man. The fission-product gamma dose for late-time dose-significant nuclides is tabulated in roentgens per hour per kiloton per square mile as a function of time.

Tritium is shown to be relatively unimportant in the civil-defense context when compared with the external gamma dose from an equal yield of fission products.

The survival of man in an environment contaminated with radioactive fallout after a nuclear attack is the basis on which the importance of tritium in the civil-defense context can be assessed. Although tritium is a weak beta emitter, the radiation hazard to man can be significant because of the high yield of residual tritium from fusion devices. Also, tritium is relatively mobile and, as tritiated water, becomes rapidly dispersed in the environment where it is available for ingestion by man. On the other hand, the hazard is reduced somewhat by the dilution of tritium with the large amount of water in the environment.

The importance of any single isotope can only be compared with respect to other radioisotopes produced in a nuclear explosion. As a first estimate, therefore, the radiation hazard to man from residual tritium is compared with that from fission-product radioactivity.

When certain reasonable assumptions are made, the dose rate as a function of time and the 30-year dose integral can be determined per unit area and unit

assumes 2 grams/mt tritium (p. 74)
and a half-reduce time for 5 to 10 days (Sedex test data for 5 drops of rain/year).

In rain, the tritium half-reduce time is just 42 days (p. 73).

EFFECTS OF BETA-GAMMA RADIATION OF EARTHWORMS UNDER SIMULATED-FALLOUT CONDITIONS

DAVID E. REICHLE, JOHN P. WITHERSPOON,
MYRON J. MITCHELL,* and CLARENCE E. STYRON†

Ecological Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee

ABSTRACT

Experiments on ^{60}Co gamma and ^{90}Sr – ^{90}Y beta radiosensitivity of *Lumbricus terrestris* and dosimetry models of soil systems were designed to study the effects of fallout radiation on natural earthworm populations. Epithelial tissues (skin and/or intestinal) were the primary sites for radiation damage. The $\text{LD}_{50/30}$ days for gamma was 67.8 krad; no significant increase in mortality occurred for beta irradiations up to 102.4 krad. In situ dosimetry models with ^{137}Cs show that beta radiation is important only for direct contact (because of soil shielding) and that gamma radiation typically would contribute from 68 to 100% of the external body dose of natural populations. Habitat shielding, high radioresistance of earthworms, and radioactive decay preceding particle incorporation into soil suggest minimal population mortality due to radiation from anticipated weapon yields.

The delivery of external radiation exposure dose to biological systems at specific locations in a fallout field is generally in the form of an acute or short-term damage phenomenon.¹ Because of the paucity of data on effects of beta dose on invertebrates,² the effects of beta and gamma radiation from nuclear fallout generally had been assumed to be comparable. Recent information on contaminated-particle retention by vegetation³ and contact doses from beta radiation⁴ suggests that areas of serious damage to organisms from fallout will be larger than previously estimated from gamma radiation alone.

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†Present address: Division of Mathematics and Natural Science, St. Andrews Presbyterian College, Laurinburg, North Carolina.

THE SIGNIFICANCE OF LONG-LIVED NUCLIDES AFTER A NUCLEAR WAR

R. SCOTT RUSSELL, B. O. BARTLETT, and R. S. BRUCE

Agricultural Research Council, Letcombe Laboratory, Wantage, Berkshire, England

ABSTRACT

The radiation doses from the long-lived nuclides ^{90}Sr and ^{137}Cs , to which the surviving population might be exposed after a nuclear war, are considered using a new evaluation of the transfer of ^{90}Sr into food chains.

As an example, it is estimated that, in an area where the initial deposit of near-in fallout delivered 100 R/hr at 1 hr and there was subsequent worldwide fallout from 5000 Mt of fission, the dose commitment would be about 2 rads to the bone marrow of the population and 1 rad to the whole body. Worldwide fallout would be responsible for the major part of these doses.

In view of the possible magnitude of the doses from long-lived nuclides, the small degree of protection that could be provided against them, and the considerable strain any such attempt would impose on the resources of the community, it seems unrealistic to consider remedial measures against doses of this magnitude. Civil-defense measures should be directed at mitigating the considerably higher doses that short-lived nuclides would cause in the early period.

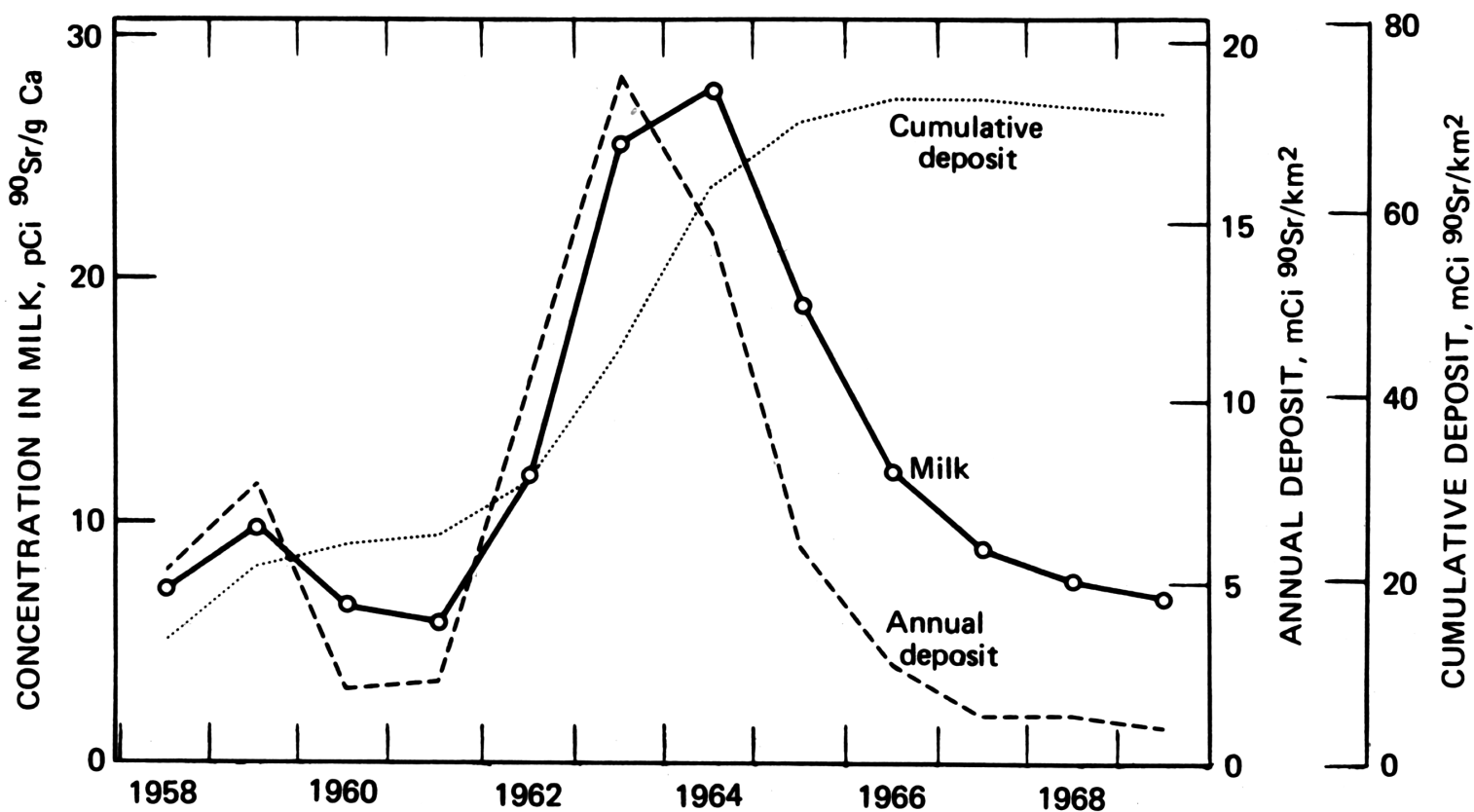


Fig. 1 Strontium-90 in fallout and milk in the United Kingdom

RADIATION EFFECTS ON FARM ANIMALS: A REVIEW

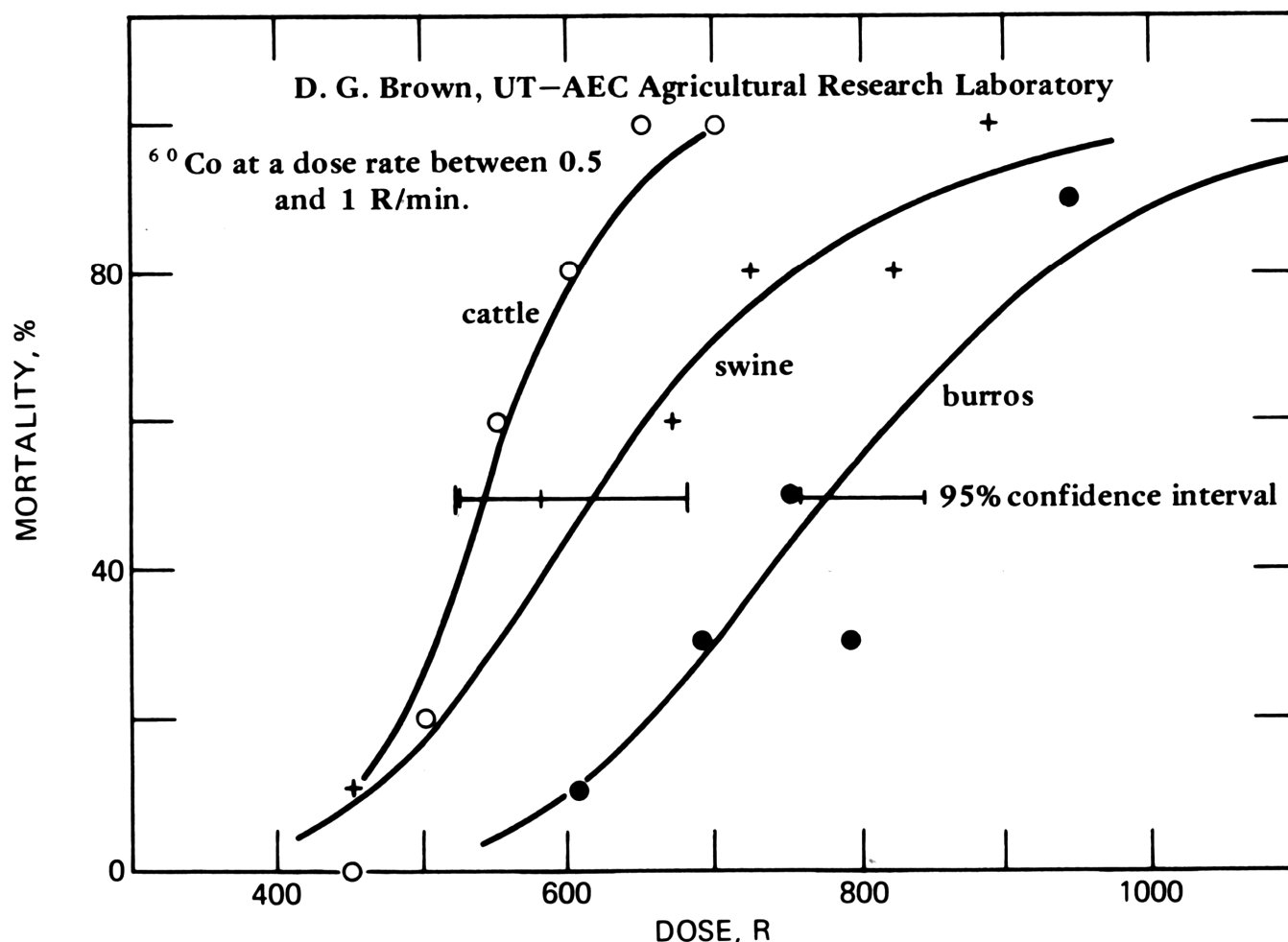
M. C. BELL

UT-AEC Agricultural Research Laboratory, Oak Ridge, Tennessee

ABSTRACT

Hematopoietic death would predominate in food-producing animals exposed to gamma radiation under fallout conditions leaving animal survivors. Gamma-radiation doses of about 900 R would be lethal to 50% of poultry, and about half this level would be lethal for cattle, sheep, and swine. Grazing cattle and sheep would suffer most from combined radiation effects of skin-beta and ingested-beta radioactivity plus the whole-body gamma effects. The $LD_{50/60}$ for combined effects in ruminants is estimated to be at a gamma exposure of around 200 R in an area where the forage retention is 7 to 9%.

Either external parasites or severe heat loss could be a problem in skin irradiated animals. Contrary to early reports, bacterial invasion of irradiated food-producing animals does not appear to be a major problem. Productivity of survivors of gamma radiation alone would not be affected, but, in an area of some lethality, the productivity of surviving grazing livestock would be severely reduced owing to anorexia and diarrhea. Sheltering animals and using stored feed as countermeasures during the first few days of livestock exposure provide much greater protection than shielding alone.



Cobalt-60 DOSE-PROTRACTION ON RADIATION LETHALITY OF SHEEP

DOSE RATE (R/MIN)	METHOD OF EXPOSURE	MEDIAN LETHAL DOSE (LD50)		REFERENCE
		MID-AIR	MID-TISSUE	
		DOSE (R)	DOSE (RADS)	
11.0	Bilateral	237	145	Hanks (1966)
4.35	Bilateral	318	194	Page (1968)
.5	Bilateral	338	206	Page (1968)
.06	Free-moving	495	302	Page (1968)
.033	Free-moving	637	389	Page (1968)

G. E. Hanks, N. P. Page, E. J. Ainsworth, G. F. Leong, C. K. Menkes, and E. L. Alpen, "Acute mortality and recovery studies in sheep irradiated with cobalt-60 gamma rays or 1 Mrp x-rays." Radiation Res. 27, 397-405 (1966).

N. P. Page, E. J. Ainsworth and G. F. Leong, "The relationship of exposure rate and exposure time to radiation injury in sheep." Radiation Res. 33, 94-106 (1968).



DOSE RATE IN MAMMALIAN RADIATION BIOLOGY

April 29 - May 1, 1968

UT-AEC

Agricultural Research Laboratory
Oak Ridge, Tennessee

United States Atomic Energy Commission

A Relation of Irradiation Dose-Rate Effects

in Mammals and in Mammalian Cells

J. L. Bateman
Medical Research Center
Brookhaven National Laboratory

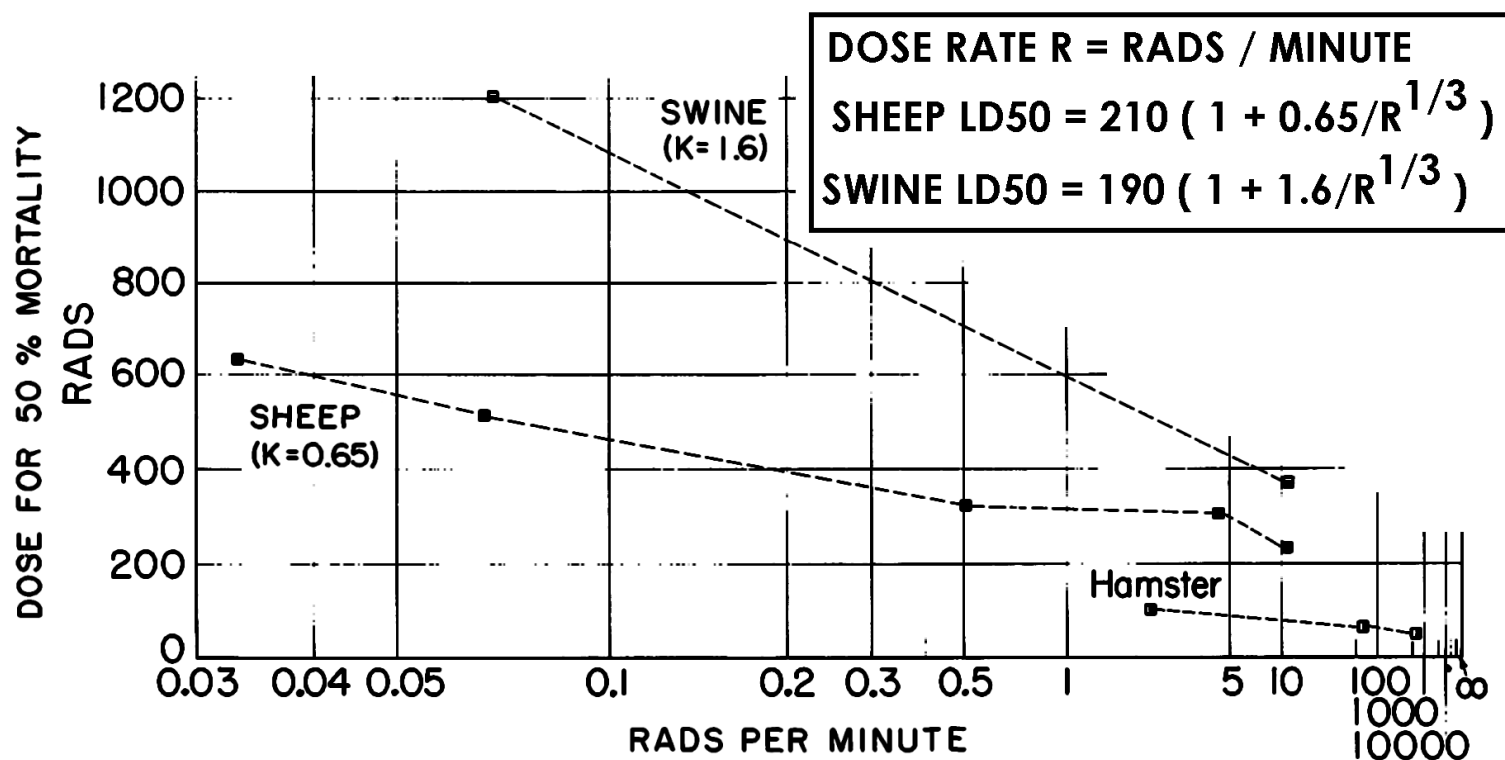
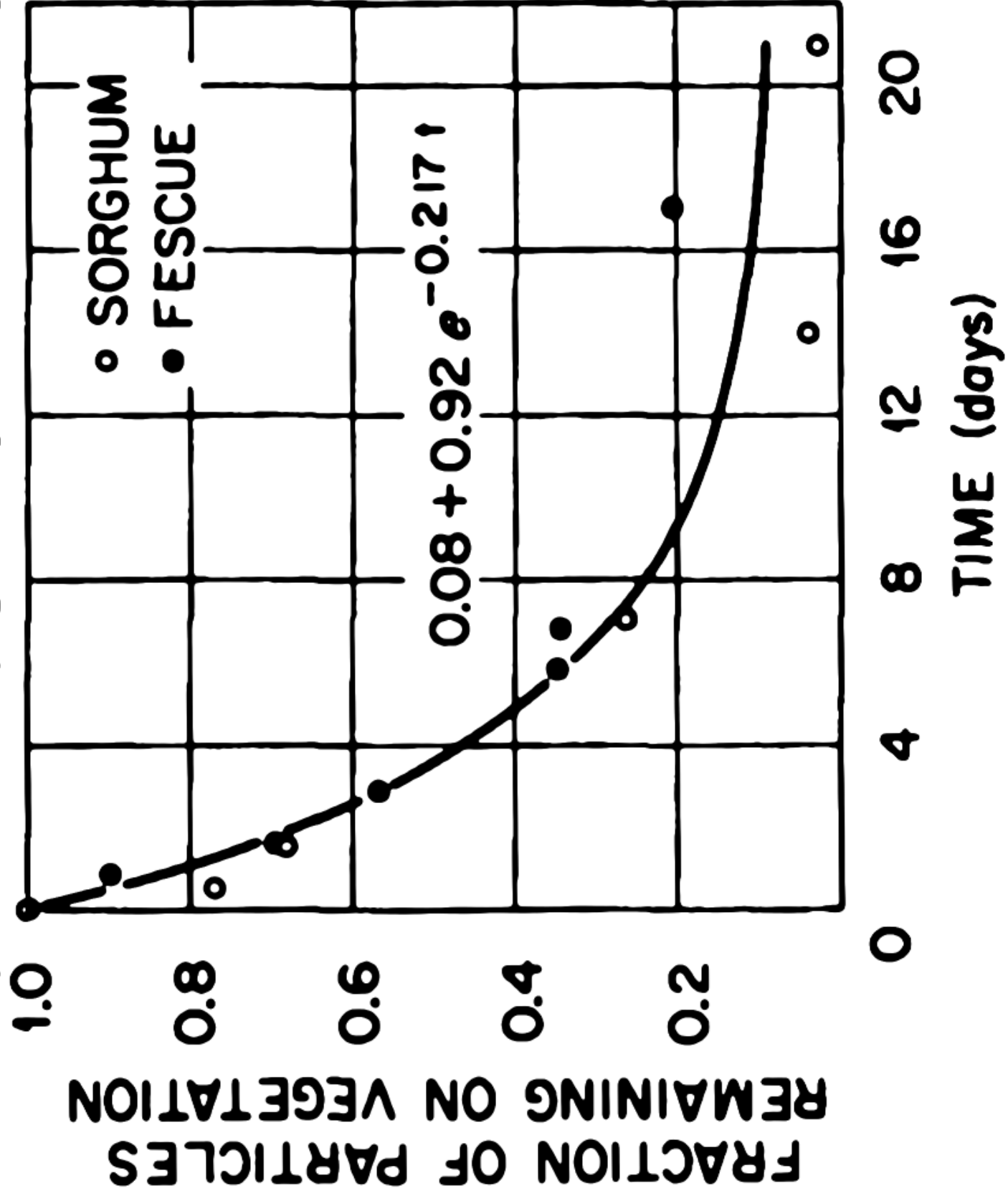
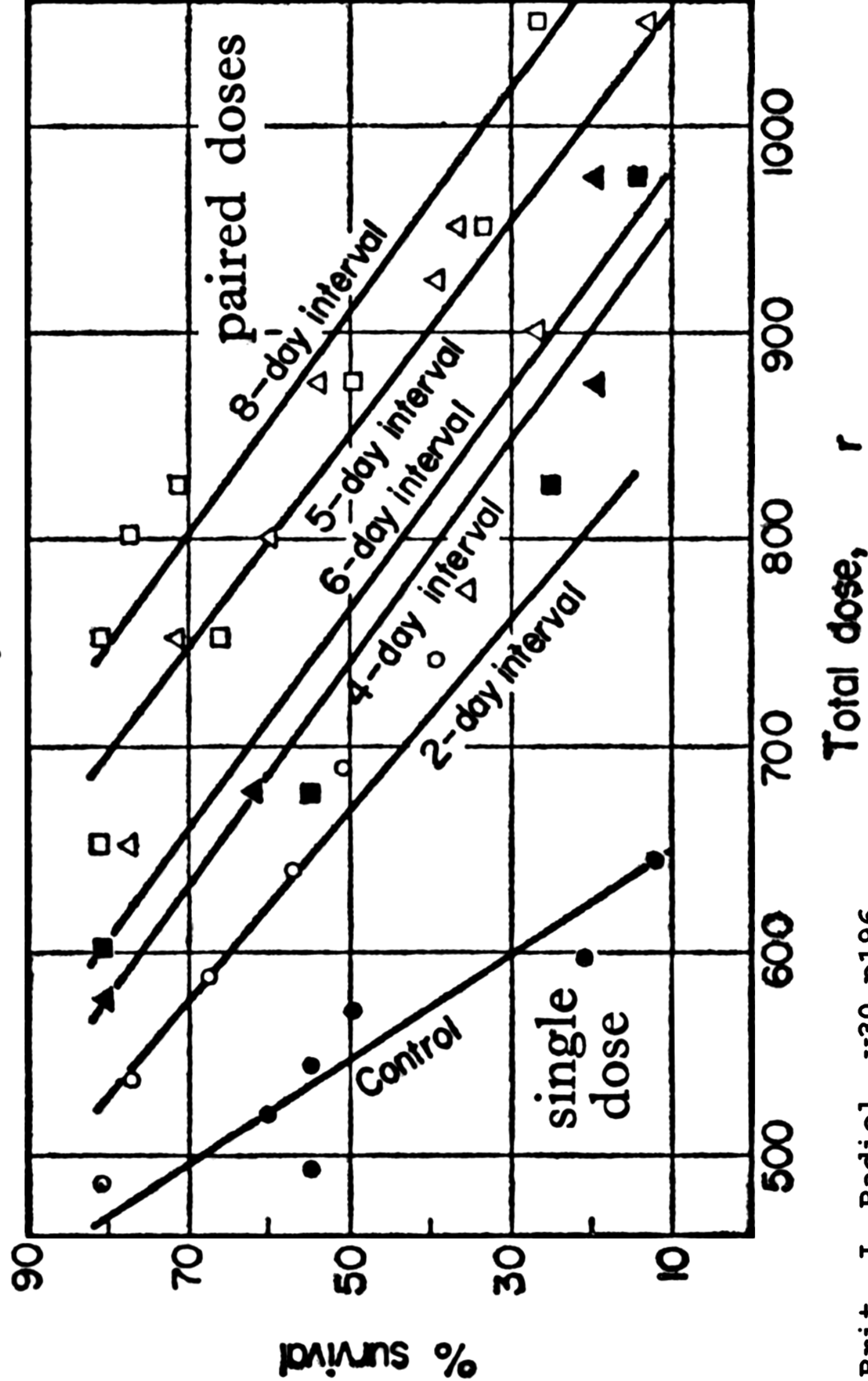


Fig. 1. Experiments in which the LD_{50} was found to be a linear function of the reciprocal cube root of dose rate.

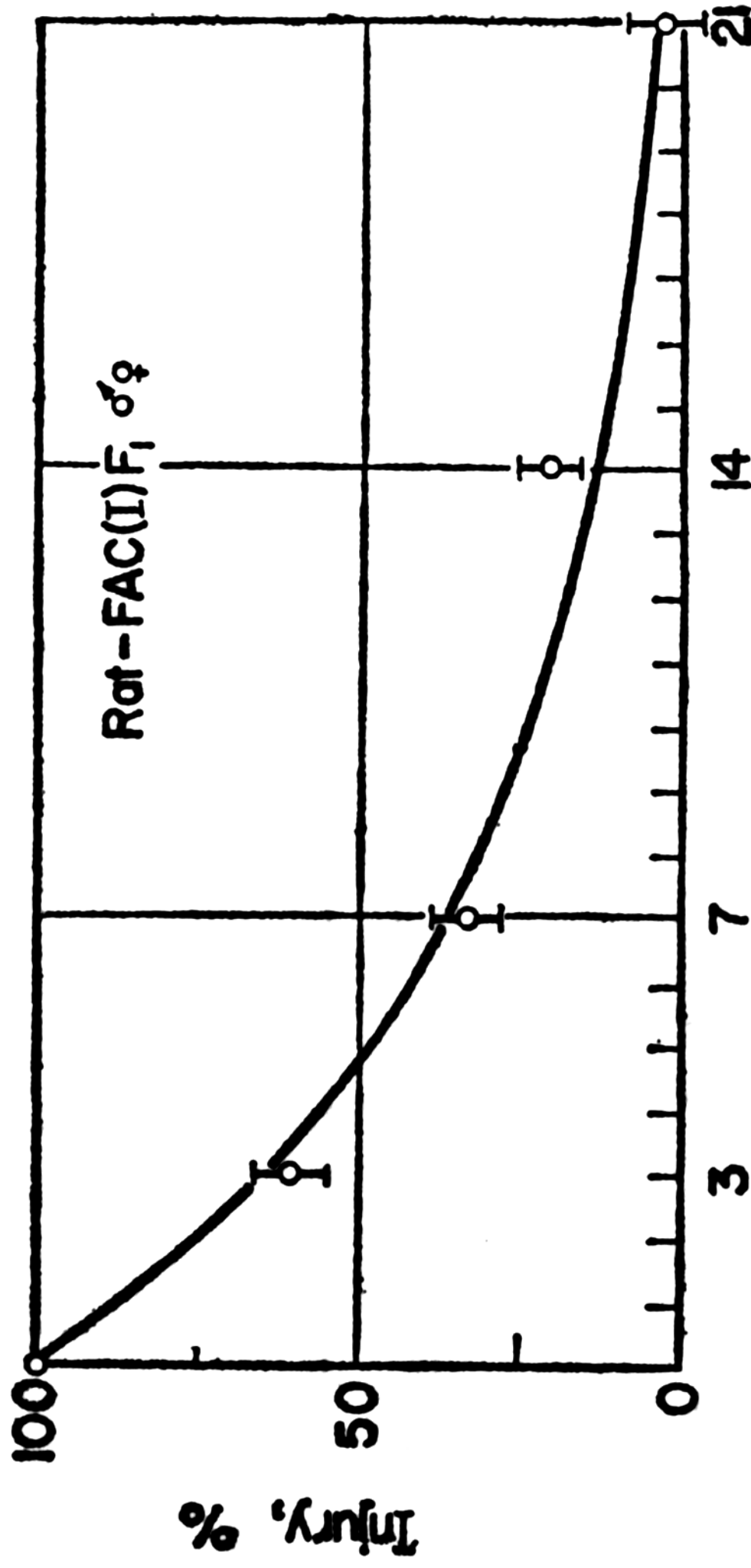
Retention of 0.044-0.118 mm diameter fallout particles by grass (ORNL-TM-3837)



Survival at 30 days of female mice



Rate of recovery (as measured by LD_{50/30} for X-rays)



Rat-FAC(I)F₁ ♂♀

Rad. Res., v7, p85 Days after irradiation, 315r

Time after exposure	Survival improbable (700 r or more)	Survival possible (550 r to 300 r)
1st week-----	Nausea, vomiting, and diarrhea in first few hours.	Nausea, vomiting, and diarrhea in first few hours.
	No definite symptoms in some cases (latent period).	No definite symptoms (latent period).
	Diarrhea Hemorrhage Purpura Inflammation of mouth and throat. Fever	
2nd week-----	Rapid emaciation Death (Mortality probably 100 percent).	Epilation Loss of appetite and general malaise. Fever
3rd week-----		Hemorrhage Purpura Petechiae Nosebleeds Pallor Inflammation of mouth and throat.

RADIOBIOLOGICAL FACTORS IN MANNED SPACE FLIGHT

**REPORT OF THE
SPACE RADIATION STUDY PANEL
OF THE
LIFE SCIENCES COMMITTEE**

**SPACE SCIENCE BOARD
NATIONAL ACADEMY OF SCIENCES
NATIONAL RESEARCH COUNCIL**

**WRIGHT H. LANGHAM
EDITOR**

**NATIONAL ACADEMY OF SCIENCES
NATIONAL RESEARCH COUNCIL**

WASHINGTON, D.C. 1967

PUBLICATION 1487

(These are mid-line doses, which are only about 70% of air dose due to self-shielding)

TABLE 12 Derived Prompt Radiation Doses for 10, 50, and 90 Percent Probability of Lethality

SAMPLE	PROBABILITY OF RESPONSE (percent)	NORMAL DISTRIBUTION DOSE (rads)
Human patients (218)	10	75±30
	50	286±25
	90	500±50
Normal monkeys (226)	10	390±22
	50	532±13
	90	678±25

TABLE 29 Estimated Absorbed Doses of High-Intensity Reference Radiation for Production of Early Prodromal Sequelae*

CLINICAL SIGN	ABSORBED DOSE FOR PROBABILITY OF RESPONSE (rads) ^b		
	10 PERCENT	50 PERCENT	90 PERCENT
Anorexia	40	100	240
Nausea	50	170	320
Vomiting	60	215	380
Diarrhea	90	240	390

*See Initial or Prodromal Syndrome, page 76.

^bAnatomical region of interest for dose estimation, a 26-cm-diameter sphere in the mid-epigastric region.

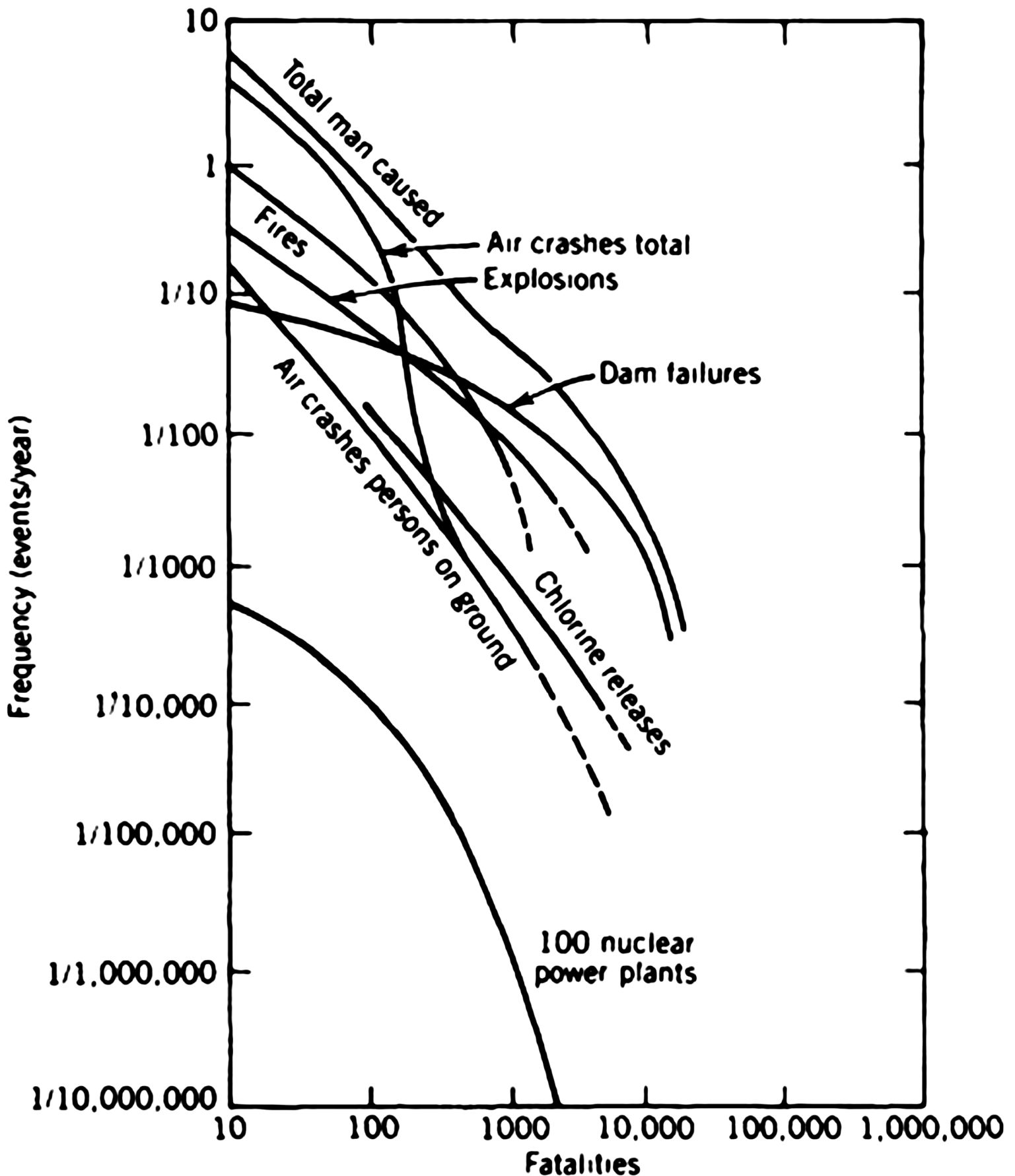
TABLE 30 Estimated Absorbed Doses of High-Intensity Reference Radiation for Production of Hematological Depression*

CIRCULATING ELEMENT	ABSORBED DOSE FOR REDUCTION FROM NORMAL (rads) ^b		
	25 PERCENT ^c	50 PERCENT ^c	75 PERCENT ^c
Platelets	50	120	250
Lymphocytes at ~30	60	150	300
Neutrophils days	80	190	390

*See Hematological Effects, page 90.

^bAnatomical region of interest for dose estimation, average depth of 5 cm, total-body exposure.

^cAt point of maximum depression, the time of which varies with dose.



WASH-1400 Reactor Safety Study (1975)

Local Fallout from Nuclear Test Detonations (U), DASA 1251-series (5 volumes with 9 separately-bound parts), by U.S. Army Nuclear Defense Laboratory for the Defense Atomic Support Agency:

Volume I, Indexed Bibliography of United States and British Documents on Characteristics of Local Fallout (U), DASA 1251-1 (AD 329971), 237 pp., 27 June 1961. (C)

Volume II, Compilation of Fallout Patterns and Related Test Data (U):

Part 1 - Trinity Through Redwing (U), DNA 1251-2-1 (AD 349123), 468 pp., August 1963. (SRD)

Part 2 - Plumbbob Through Hardtack (U), DASA 1251-2-2 (AD 329124), 456 pp., August 1963. (SRD)

Part 3 - Nougat Through Niblic (U), DASA 1251-2-3 (AD 371725), 226 pp., March 1966. (SRD)

Supplement, Foreign Nuclear Tests (U), DASA 1251 (AD 358417L), 77 pp., October 1964. (SRD)

Volume III, Annotated Compendium of Data on Physical and Chemical Properties of Fallout (U), DASA 1251-3 (AD 381963L), 770 pp., November 1966. (SRD)

Volume IV, Annotated Compendium of Data on Radiochemical and Radiation Characteristics of Fallout (U):

Part 1 - Specific Activity, Activity-Size Distribution, Decay (U), DASA 1251-4-1 (AD 500919L), 643 pp., September 1968. (SRD)

Part 2 - Radiochemical Composition, Induced Activity, Gamma Spectra (U), DASA 1251-4-2 (AD 523385), 570 pp., 31 May 1972. (SRD)

Volume V, Transport and Distribution of Local (Early) Fallout from Nuclear Weapon Tests (U), DASA 1251-5 (AD 362012), 580 pp., May 1965. (SRD)

Environmental Radiation Protection Factors
Provided by Civilian Vehicles

Vehicle	Position	Protection Factor Range
Commercial bus (common type)	Throughout bus	1.5-2.0
Commercial bus (scenic cruiser type)	Throughout bus	1.5-2.0
School bus	Throughout bus	1.5-1.8
Passenger car	Passenger side (chest)	1.5-1.7
	Driver side	1.5-1.7
Pickup	Driver side	1.9-2.1
Crew cab	Driver side	1.8-2.0
	Back seat	1.8-2.0
Carryall	Driver side	1.7-1.9
	Rear side	1.7-1.9
2-1/2-ton truck	Driver side	1.8-2.0
	Center of bed	1.4-1.6
5-ton truck	Driver side	2.0-2.2
	Sleeper	1.9-2.1
Heavy Truck	Driver side	1.4-1.6
	Center of trailer	2.7-3.1
Fire truck	Driver side	2.7-3.1
	Standing area in back	1.6-1.8
Switch engine	Engineer's seat	3.0-3.5
Railway guard car	Sleeping quarters	2.2-2.6
	Kitchen area	2.4-2.8
	Center area	2.0-2.4
Heavy locomotive	Engineer's seat	3.0-3.5

SOURCE: Z. G. Burson, "Environmental and Fallout Gamma Radiation Protection Factors Provided by Civilian Vehicles," Health Physics, 26, 41-44, 1974.

HOME OFFICE
SCOTTISH HOME DEPARTMENT

MANUAL OF CIVIL DEFENCE

Volume I

PAMPHLET No. 1

NUCLEAR WEAPONS

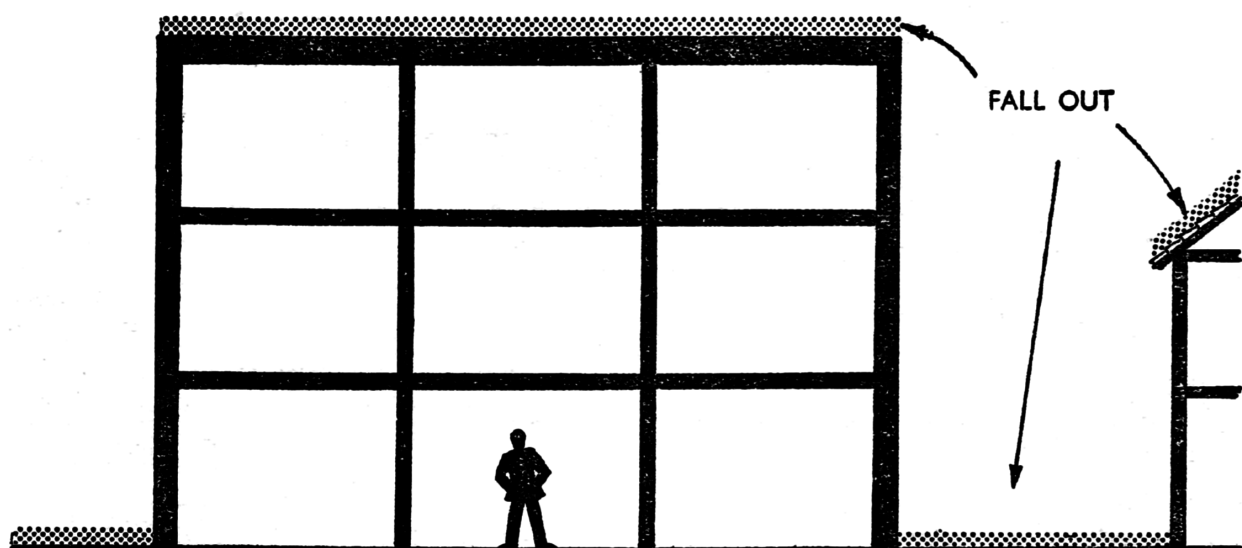
LONDON
HER MAJESTY'S STATIONERY OFFICE
1956

Practical protection

- 88** Large buildings with a number of storeys, especially if they are of heavy construction, provide much better protection than small single-storey structures (see Figure 4). Houses in terraces likewise provide much better protection than isolated houses because of the shielding effect of neighbouring houses.

GOOD PROTECTION

Solidly constructed multi-storeyed building with occupants well removed from fall-out on ground and roof. The thickness of floors and roof overhead, and the shielding effect of other buildings, all help to cut down radiation



BAD PROTECTION

Isolated wooden bungalow

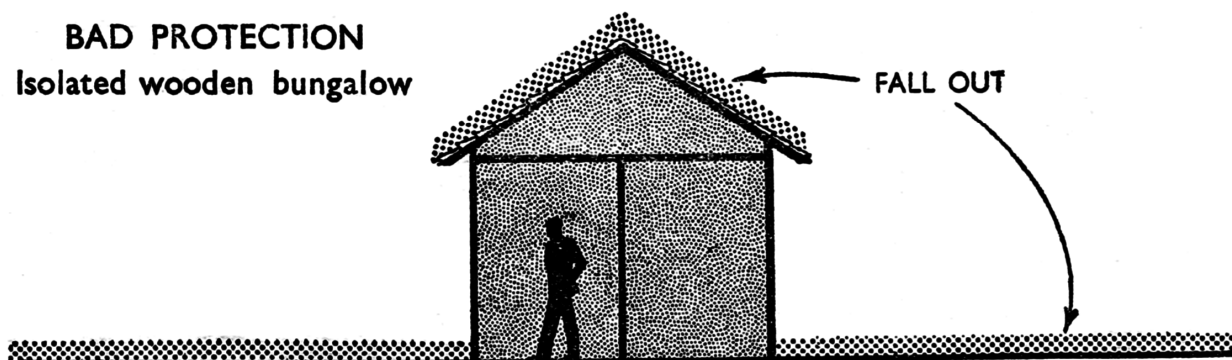


FIGURE 4

Examples of good and bad protection afforded by buildings against fall-out.

- 89** It is estimated that the protection factor (the factor by which the outside dose has to be divided to get the inside dose) of a ground floor room in a two-storey house ranges from 10 to about 50, depending on wall thickness and the shielding afforded by neighbouring buildings. The corresponding figures for bungalows are about 10–20, and for three-storey houses about 15–100. An average two-storey brick house in a built-up area gives a factor of 40, but basements, where the radiation from outside the house is attenuated by a very great thickness of earth, have protection factors ranging up to 200–300. A slit trench with even a light cover of boards or corrugated iron without earth overhead gives a factor of 7, and if 1 ft. of earth cover is added the

factor rises to 100. If the trench can be covered with 2 or 3 feet of earth then a factor of more than 200–300 can be obtained (see Figure 5).

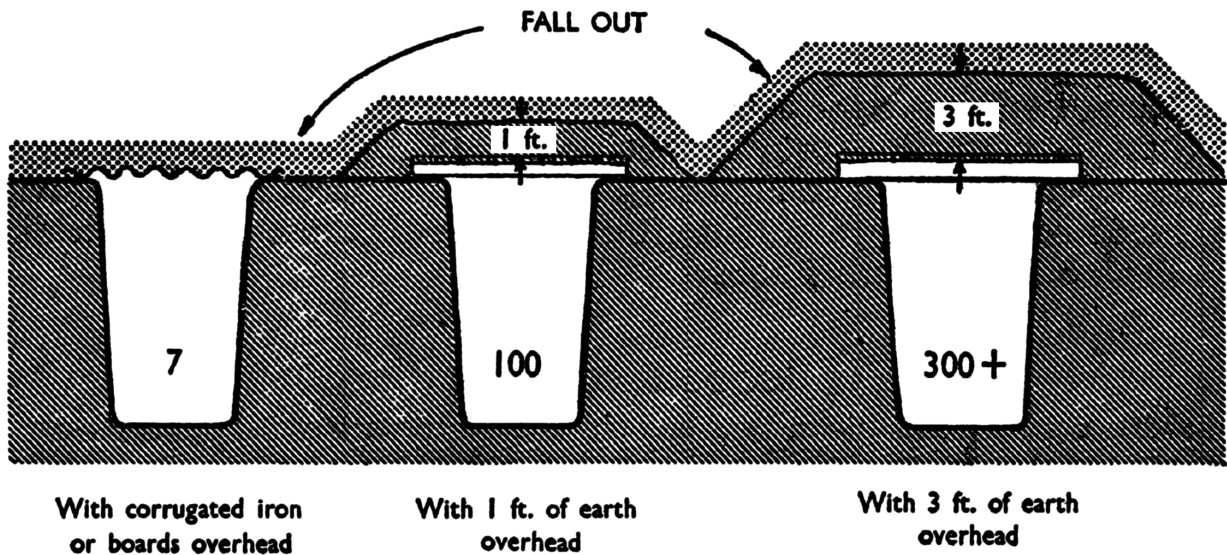


FIGURE 5

Protection factors in slit trenches (the factor by which the outside dose is divided to get the inside dose).

Choosing a refuge room

- 90 In choosing a refuge room in a house one would select a room with a minimum of outside walls and make every effort to improve the protection of such outside walls as there were. In particular the windows would have to be blocked up, e.g. with sandbags. Where possible, boxes of earth could be placed round an outside wall to provide additional protection, and heavy furniture (pianos, bookcases etc.) along the inside of the wall would also help. A cellar would be ideal. Where the ground floor of the house consists of boards and timber joists carried on sleeper walls it may be possible to combine the high protection of the slit trench with some of the comforts of the refuge room by constructing a trench under the floor.

Once a trap door had been cut in the floor boards and joists and the trench had been dug, there would be no further interference with the peace-time use of the room.

Estimated under-cover doses in the fall-out area

- 91 Taking an average protective factor of 40 for a two-storey house in a built-up area, the doses accumulated in 36 hours for the ranges referred to in the U.S. Atomic Energy Commission Report (paragraph 84) would have been:—

190 miles downwind	7½r
160 " "	12½r
140 " "	20r

*15 Megatons
Bravo 1954*

which are all well below the lowest figure of 25r referred to in Table 1. At closer ranges along the axis of the fall-out, the doses accumulated in 36 hours would have been much higher, but over most of the contaminated area—with this standard of protection—the majority of those affected would have been saved from death, and even from sickness, by taking cover continuously for the first 36 hours.

5. Radiation sickness

Assume dose incurred in a single shift (3–4 hours) by the “average” man, over the whole body:—

25 roentgens	—No obvious harm.
100 ,,	—Some nausea and vomiting.
500 ,,	—Lethal to about 50 per cent. people (death up to 6 weeks later).
800 ,,	or more—Lethal to all (death up to 6 weeks later).

Note: If dose spread uniformly over 2–3 days, then 60 roentgens could be incurred with no more effect than 25 roentgens in a single exposure of 3–4 hours.

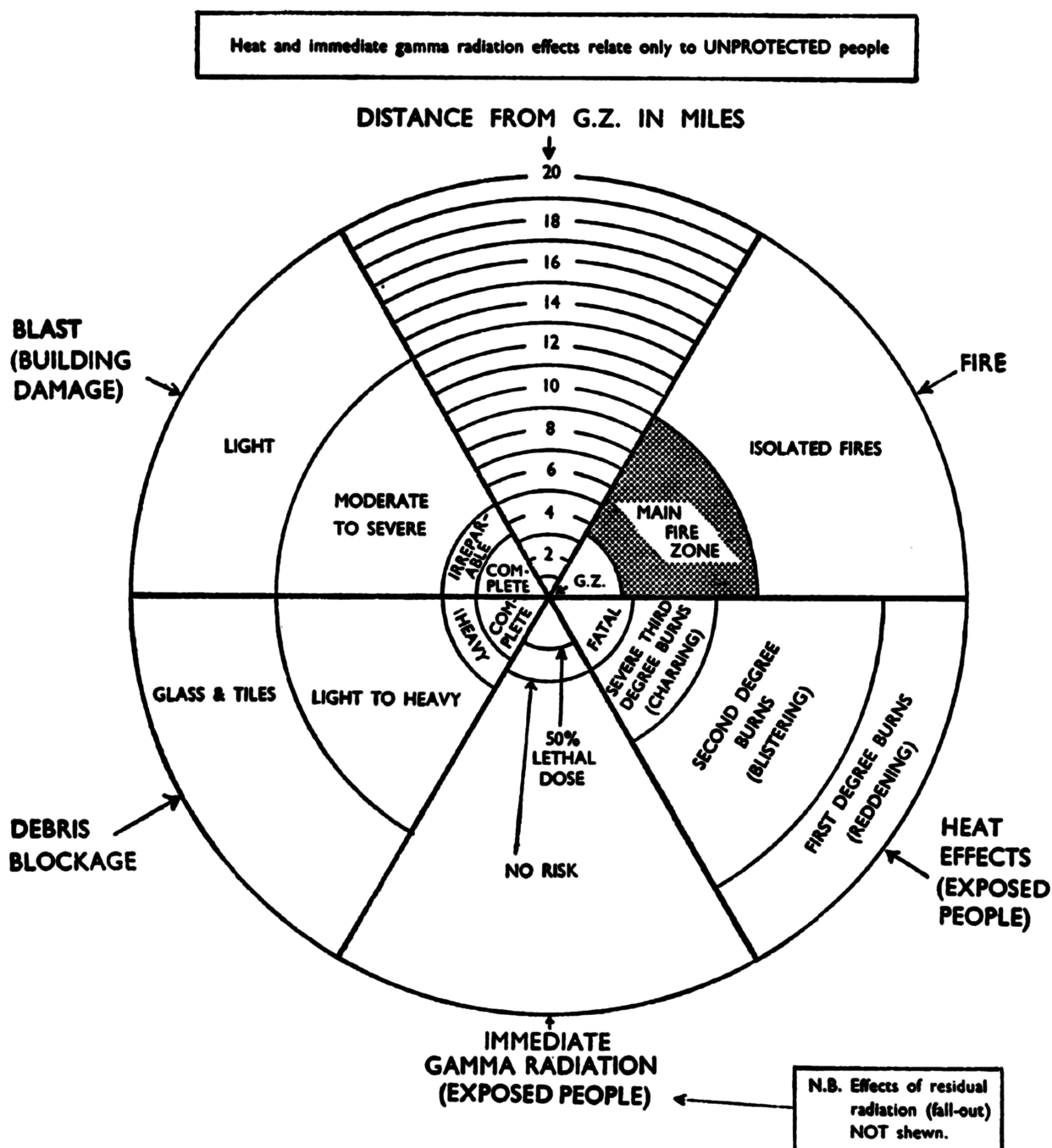


FIGURE 11

Combined effects (excluding residual radioactivity) from a 10 megaton ground burst bomb. Heat and immediate gamma radiation effects relate only to UNPROTECTED people.

HOME OFFICE
SCOTTISH HOME DEPARTMENT

MANUAL OF CIVIL DEFENCE

Volume I

PAMPHLET No. 2

RADIOACTIVE FALL-OUT

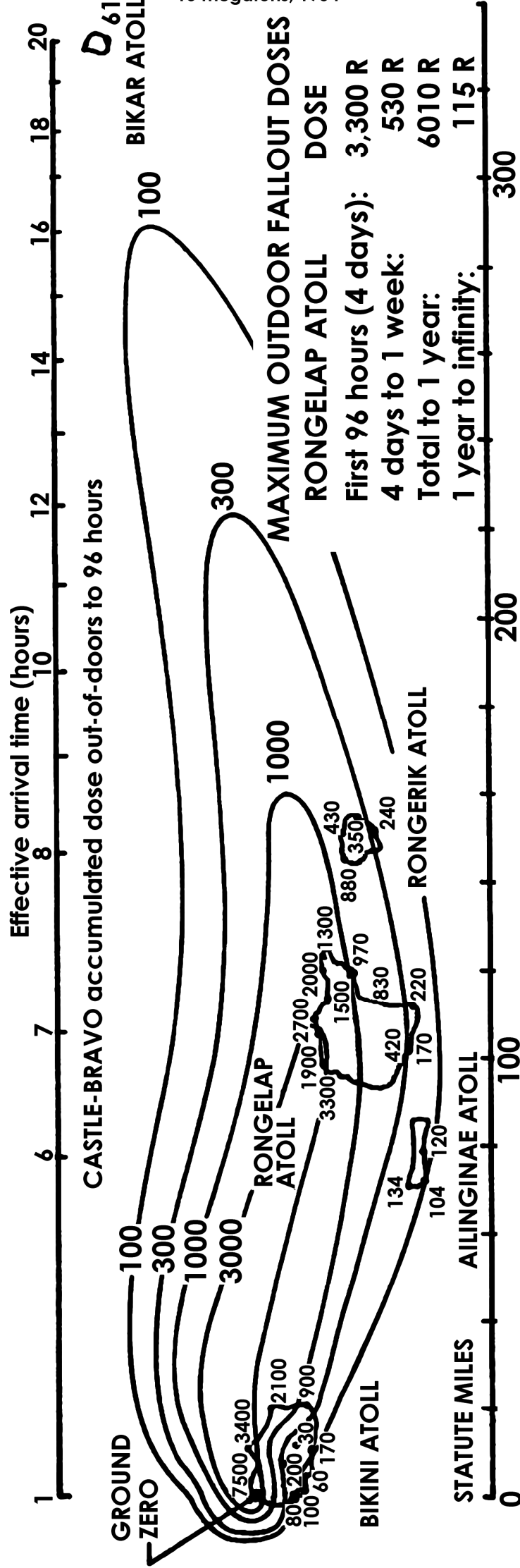
PROVISIONAL SCHEME OF
PUBLIC CONTROL

LONDON
HER MAJESTY'S STATIONERY OFFICE
1956

Radioactive Fall-out—Summary of Provisional Control Zones

Zone	Definition of Zone Boundaries	Range of Cumulative Doses in open at 48 hours	Summary of permissible and recommended action	Range of Cumulative Doses assuming observance of control rules
W	Outer: Limit of area placed under "Black Warning" (see Footnote). Inner: 0.3 r.p.h. at 48 hrs.	Up to 80r	Complete release from refuge as soon as dose-rate fell to 0.3 r.p.h. or, if the rate had not reached that figure, when fall-out was complete.	At 48 hrs. Below 2r
X	Outer: 0.3 r.p.h. at 48 hrs. Inner: 3 r.p.h. at 48 hrs.	80-800r	Qualified release from refuge after 48 hrs.—indoor workers to follow normal occupations, but not to exceed 4 hrs. per day in the open. Outdoor workers to work half shifts for next five days. At the end of this period the zone would be normal, except that all would be advised to be out of doors as little as possible and not in any case to exceed 8 hrs. per day in the open for the next three months.	At 48 hrs. 2-20r At 7 days 6-60r At 5 wks. 12-120r At 3 mths. 14-145r
Y	Outer: 3 r.p.h. at 48 hrs. Inner: 10 r.p.h. at 48 hrs.	800-2,800r	Release from refuge under stringent control after 48 hrs. For the next 12 days people should not leave their refuge for longer than necessary. Time in the open should not exceed 2 hrs. per day and time under cover, but not in refuge, a further 8 hrs. On this basis essential indoor workers should be able to get to their places of work, but outdoor work would remain suspended; a relaxation would be possible after the first fortnight and further easement in another three weeks. For the rest of the first year, however, people in this zone should not exceed 8 hrs. a day in the open.	At 48 hrs. 20-70r At 14 days 50-170r At 5 wks. 70-240r At 3 mths. 95-330r
Z	10 r.p.h. at 48 hrs.	Above 2,800r	All movement outside refuge accommodation in this zone would be dangerous. People should remain in refuge until instructions for clearance were given—they should then leave the zone by the quickest available route if they had means of transport or wait in their refuge to be collected if they had not. The clearance operation might start after 48 hrs. and removal from the zone would be for at least 3 months.	At 48 hrs.—Above 70r

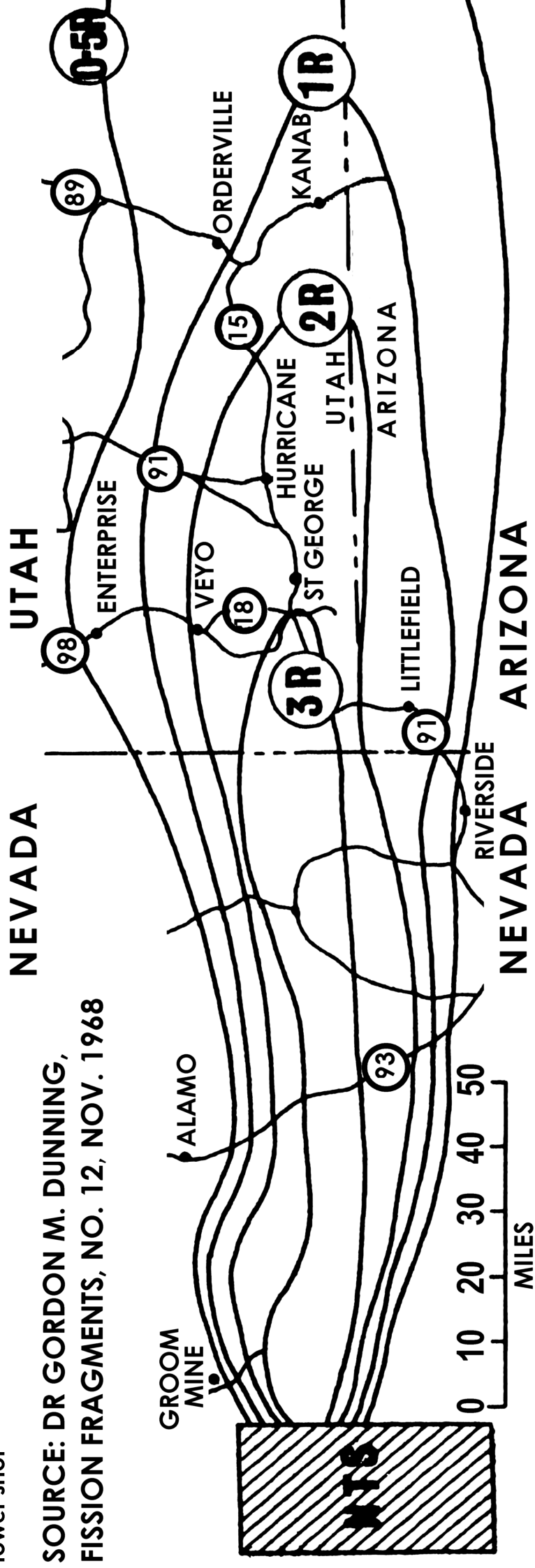
The initial Zone W boundary would be defined by the boundaries of a series of warning districts on the flanks of the fall-out. After 48 hrs. Zone W would for public control purposes have disappeared: its outer boundary would have moved during the period to coincide with the outer boundary of Zone X. The question of defining an area extending in some places beyond Zone W in which there might be an agricultural hazard is being studied.

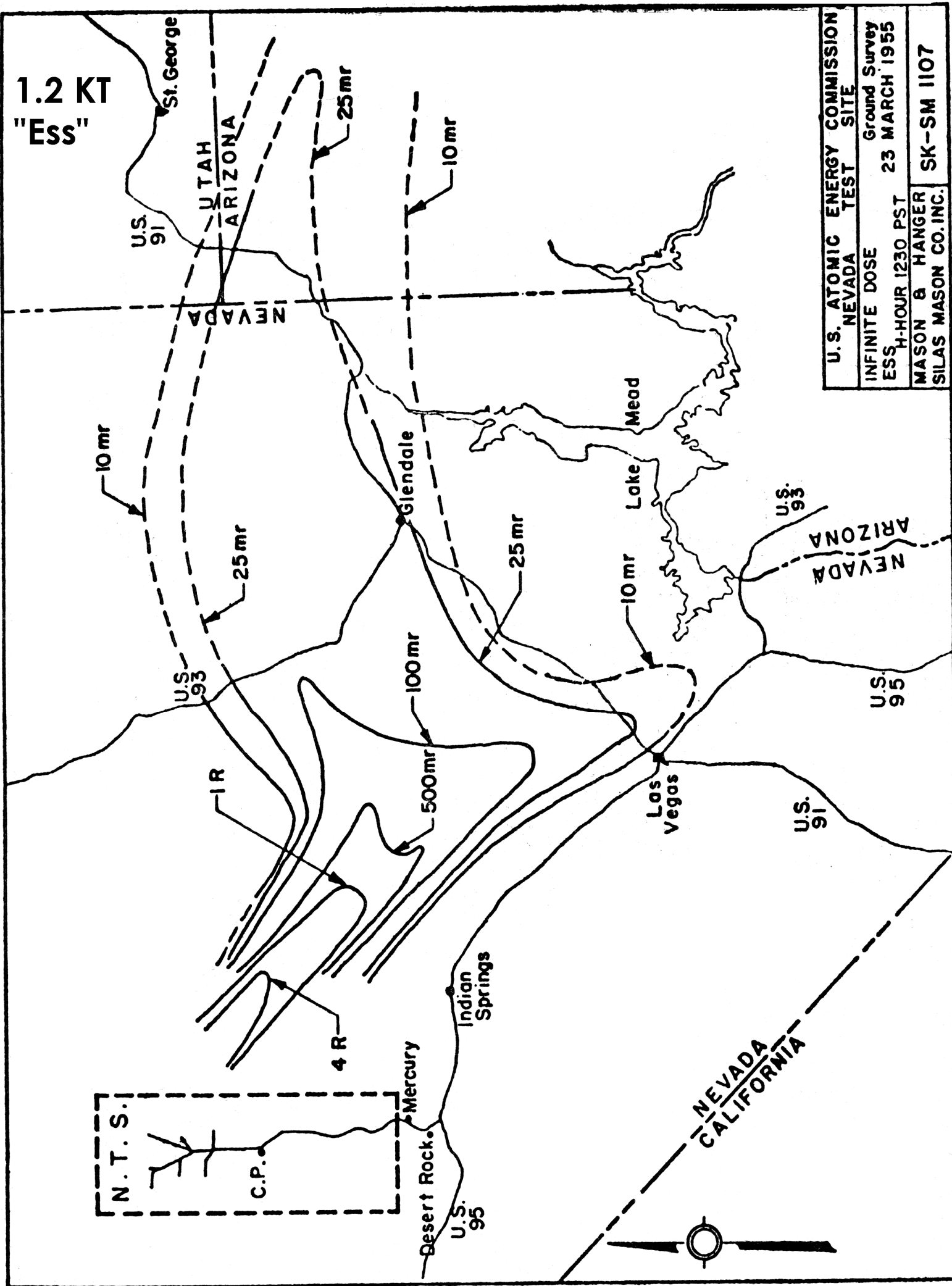


32 kt, 300ft
tower shot

GAMMA DOSE FROM UPSHOT-KNOTHOLE SHOT HARRY, 19 MAY 1953

SOURCE: DR GORDON M. DUNNING,
FISSION FRAGMENTS, NO. 12, NOV. 1968

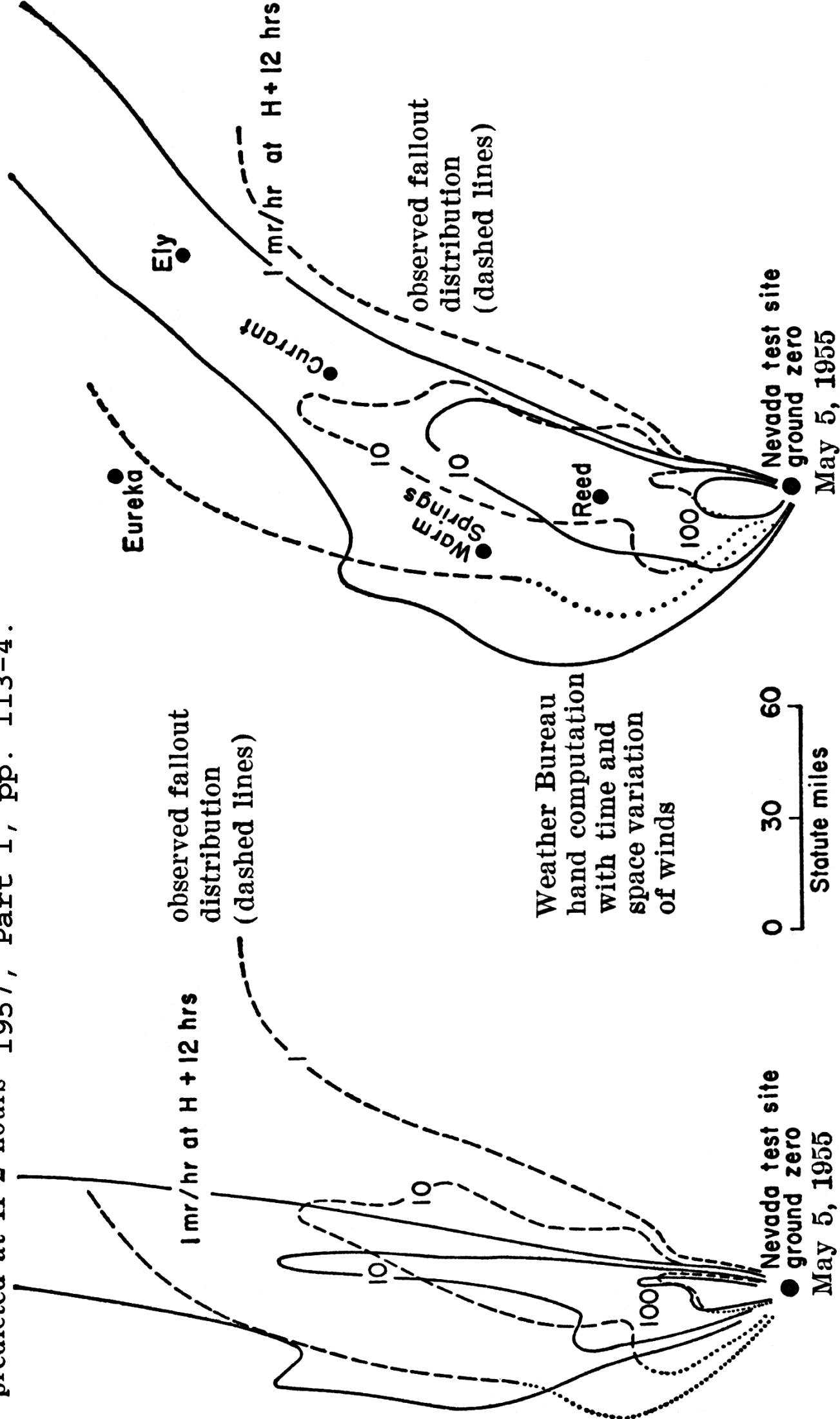




U.S. ATOMIC ENERGY COMMISSION NEVADA TEST SITE		
INFINITE DOSE	Ground Survey	
ESS	H-HOUR 1230 PST	23 MARCH 1955
MASON & HANGER	SK-SM 1107	
SILAS MASON CO. INC.		

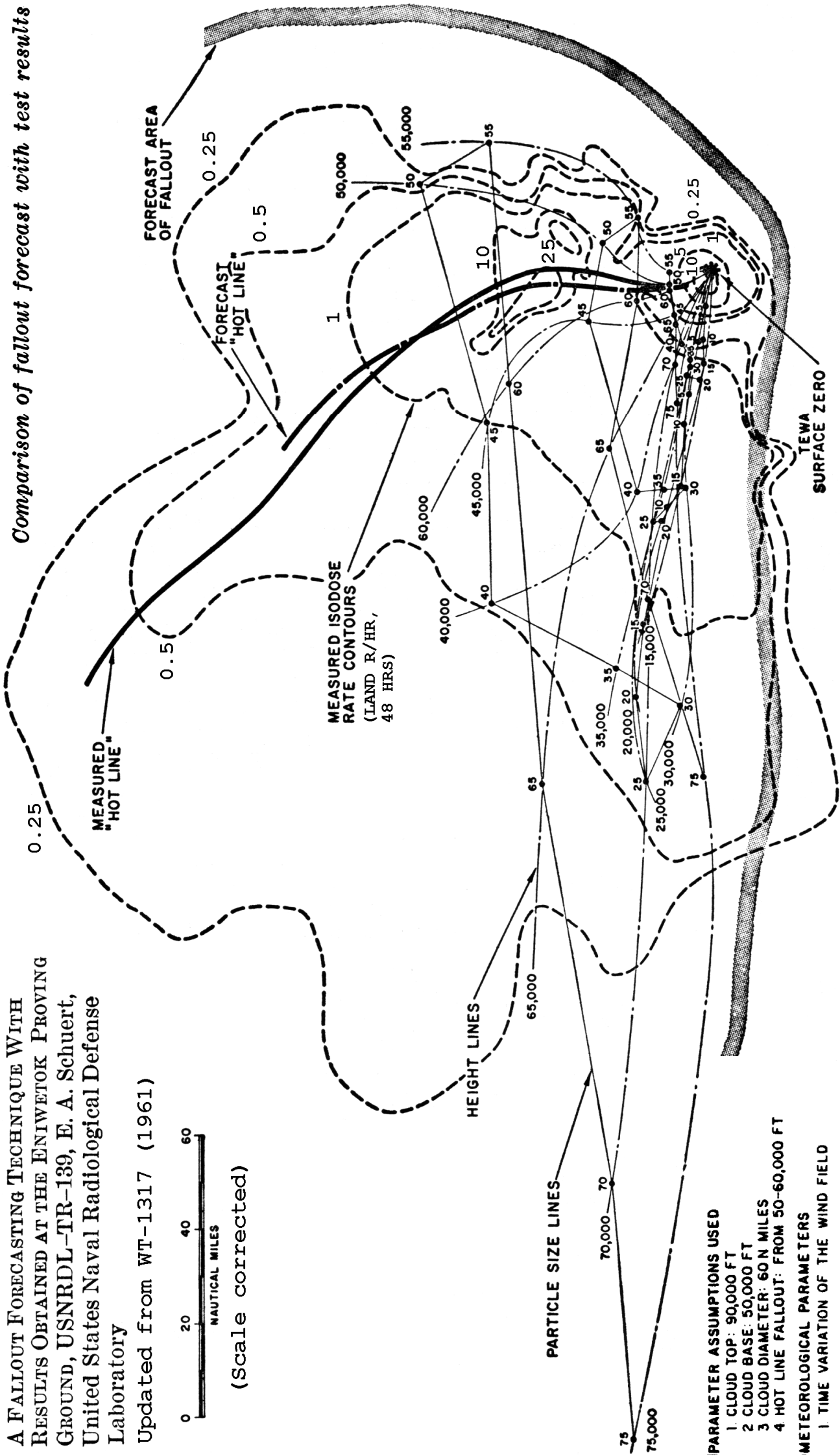
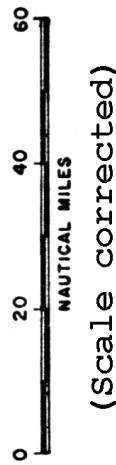
Weather Bureau
fallout distribution
predicted at H-2 hours

Testimony of Dr W. W. Kellogg (RAND Corp.) to U.S. Congress
The Nature of Radioactive Fallout and Its Effects on Man,
1957, Part 1, pp. 113-4.

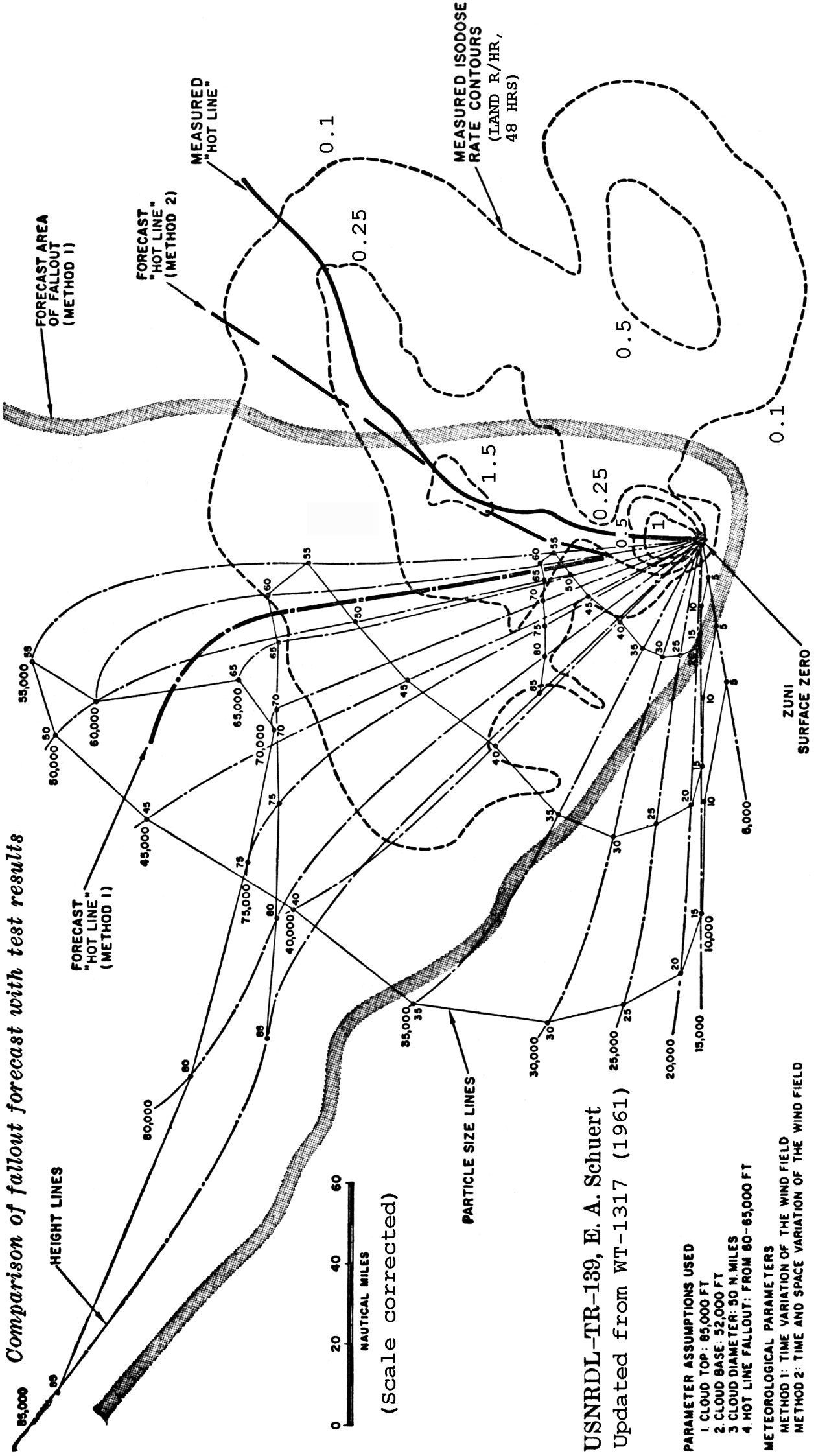


**A FALLOUT FORECASTING TECHNIQUE WITH
RESULTS OBTAINED AT THE ENIWETOK PROVING
GROUND, USNRDL-TR-139, E. A. Schuert,
United States Naval Radiological Defense
Laboratory**

Updated from WT-1317 (1961)



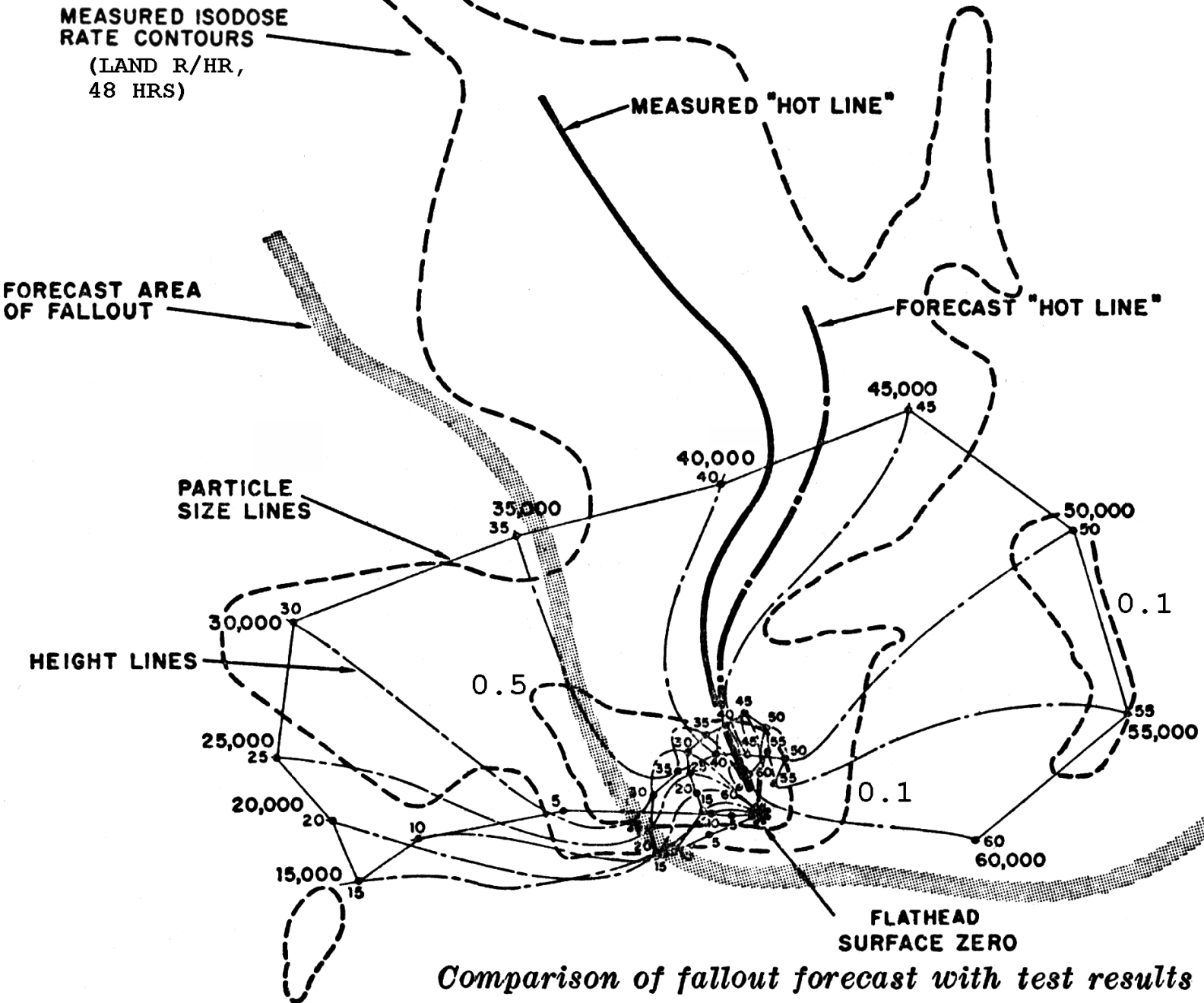
Comparison of fallout forecast with test results



USNRDL-TR-139
WT-1317 (1961)

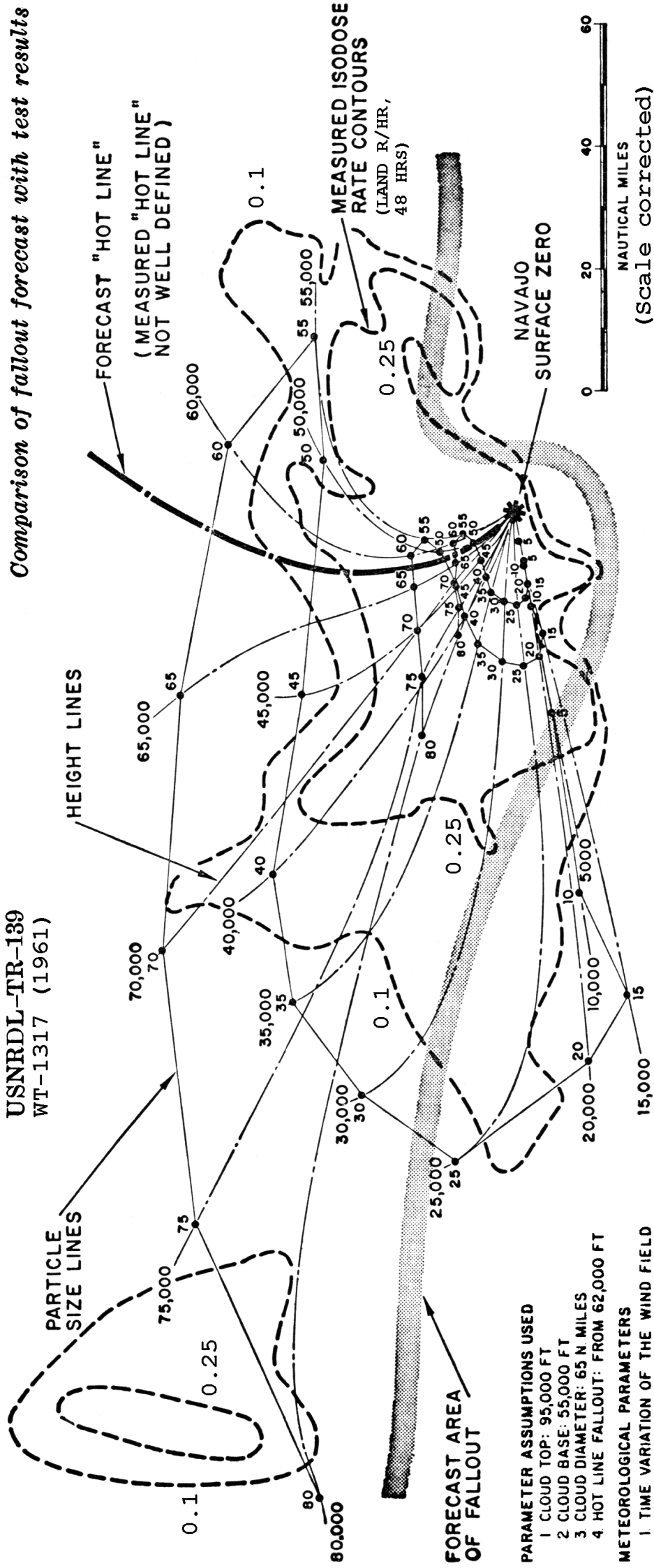


- PARAMETER ASSUMPTIONS USED
- 1. CLOUD TOP: 60,000 FT
 - 2. CLOUD BASE: 40,000 FT
 - 3. CLOUD DIAMETER: 14 N. MILES
 - 4. HOT LINE FALLOUT: FROM 43,000 FT
- METEOROLOGICAL PARAMETERS
- 1. TIME VARIATION OF THE WIND FIELD



USNRDL-TR-139
WT-1317 (1961)

Comparison of fallout forecast with test results



DEPARTMENT OF THE ARMY FIELD MANUAL

MARINE CORPS FLEET MARINE FORCE MANUAL

FM 101-31-1
FMFM 11-4

STAFF OFFICERS' FIELD MANUAL
NUCLEAR WEAPONS EMPLOYMENT
DOCTRINE AND PROCEDURES

DEPARTMENTS OF THE ARMY AND THE NAVY
FEBRUARY 1968

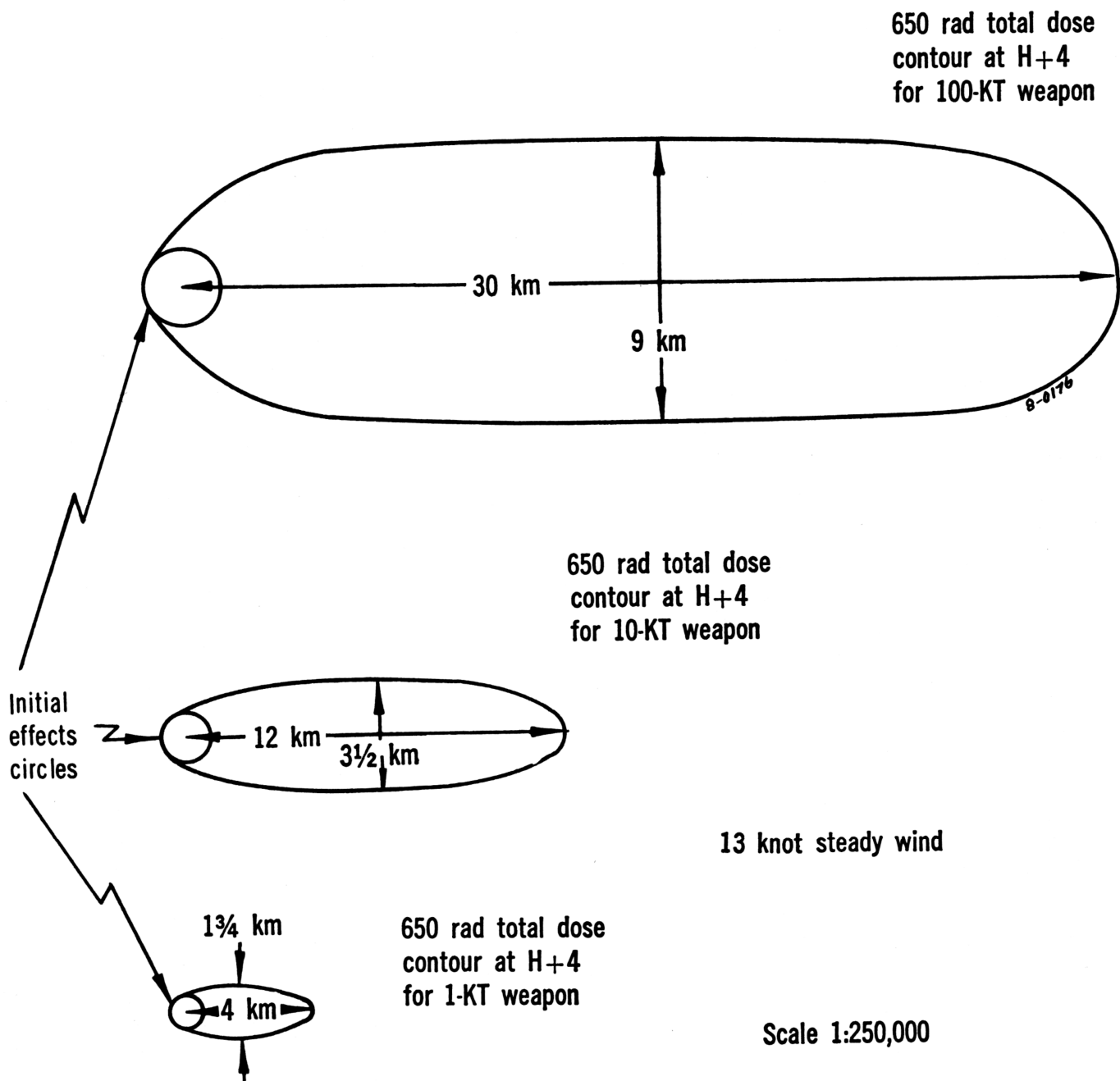


Figure 4-6. Comparison of initial effects and residual effects from 100-, 10-, and 1-kiloton surface bursts.

EFFECT	RISK LEVEL	VULNERABILITY CATEGORY							
		UNWARNED EXPOSED				WARNED EXPOSED			
T H E R M A L	Negligible	1° burns to bare skin 2.5 percent				1° burns under summer uniform 2.5 percent			
		kilotons	0.01	0.1	1	10	100	1000	
		cal/cm ²	0.85	1.0	1.15	1.3	1.5	1.75	
	Moderate	1° burns to bare skin 5 percent				1° burns under summer uniform 5 percent			
		kilotons	0.01	0.1	1	10	100	1000	
		cal/cm ²	.95	1.1	1.3	1.5	1.75	2.0	
	Emergency	2° burns to bare skin 5 percent				2° burns under summer uniform 5 percent			
		kilotons	0.01	0.1	1	10	100	1000	
		cal/cm ²	1.5	1.7	1.9	2.2	2.9	4	
			W	1	10	100	1000		
			Q	3.6	4.5	6.3	8.8		
			W	1	10	100	1000		
			Q	4	5.2	7.2	10		
			W	1	10	100	1000		
			Q	4.7	6.1	8.8	12.5		

Figure 6-1. Troop safety criteria.

HISTORY OF CIVIL DEFENSE APPROPRIATIONS

IN CONSTANT FY 1986 DOLLARS

\$MILLIONS

1.2B

1.1B

1B

900

800

700

600

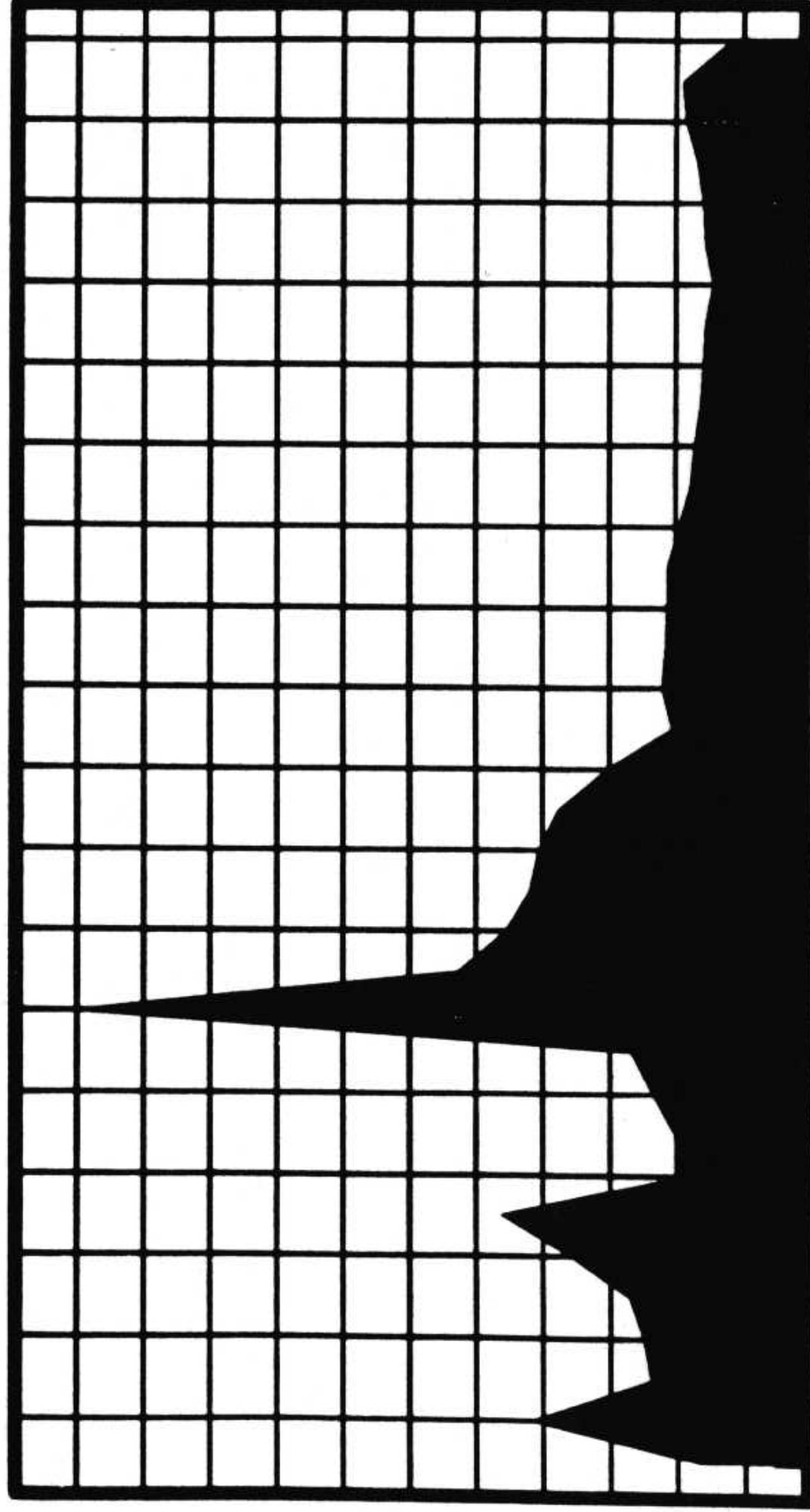
500

400

300

200

100



52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86

FISCAL YEAR

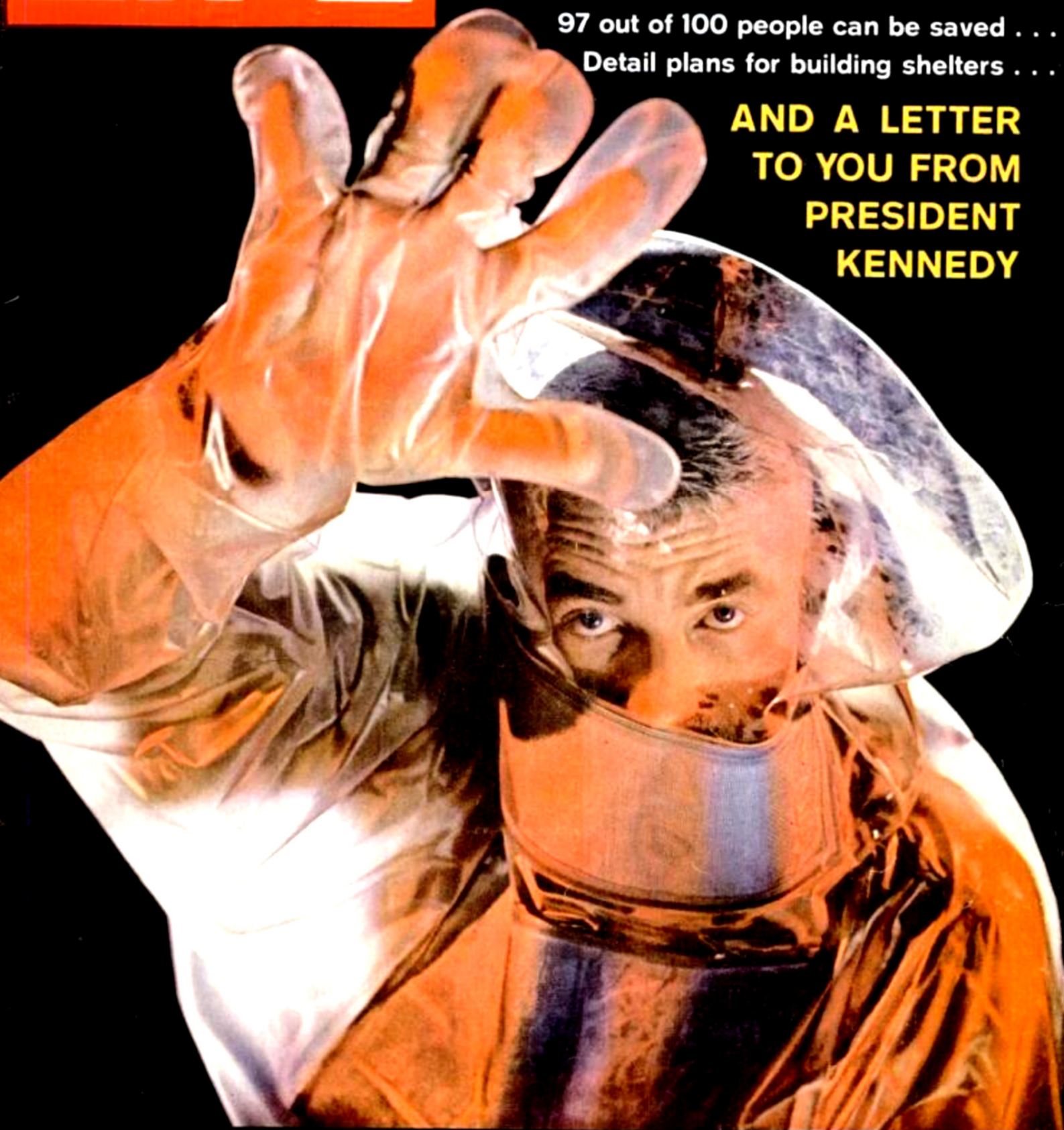
LIFE

HOW YOU CAN **SURVIVE FALLOUT**

97 out of 100 people can be saved . . .

Detail plans for building shelters . . .

**AND A LETTER
TO YOU FROM
PRESIDENT
KENNEDY**



CIVILIAN FALLOUT SUIT

SEPTEMBER 15 • 1961 • 20¢

A MESSAGE TO YOU FROM THE PRESIDENT

The White House
September 7, 1961

My Fellow Americans:

Nuclear weapons and the possibility of nuclear war are facts of life we cannot ignore today. I do not believe that war can solve any of the problems facing the world today. But the decision is not ours alone.

The government is moving to improve the protection afforded you in your communities through civil defense. We have begun, and will be continuing throughout the next year and a half, a survey of all public buildings with fallout shelter potential, and the marking of those with adequate shelter for 50 persons or more. We are providing fallout shelter in new and in some existing federal buildings. We are stocking these shelters with one week's food and medical supplies and two weeks' water supply for the shelter occupants. In addition, I have recommended to the Congress the establishment of food reserves in centers around the country where they might be needed following an attack. Finally, we are developing improved warning systems which will make it possible to sound attack warning on buzzers right in your homes and places of business.

More comprehensive measures than these lie ahead, but they cannot be brought to completion in the immediate future. In the meantime there is much that you can do to protect yourself—and in doing so strengthen your nation.

I urge you to read and consider seriously the contents of this issue of LIFE. The security of our country and the peace of the world are the objectives of our policy. But in these dangerous days when both these objectives are threatened we must prepare for all eventualities. The ability to survive coupled with the will to do so therefore are essential to our country.



John F. Kennedy

Fallout Shelters

**YOU COULD BE AMONG THE 97% TO SURVIVE
IF YOU FOLLOW ADVICE ON THESE PAGES . . .
HOW TO BUILD SHELTERS . . . WHERE TO HIDE
IN CITIES . . . WHAT TO DO DURING AN ATTACK**

PERSONAL AND FAMILY SURVIVAL

SM-3-11

“...the history of this planet and particularly the history of the 20th Century is sufficient to remind us of the possibilities of an irrational attack, a miscalculation, and accidental war, or a war of escalation in which the stakes by each side gradually increase to the point of maximum danger which cannot be either foreseen or deterred. It is on this basis that civil defense can be readily justified—as insurance for the civilian population in case of enemy miscalculation. It is insurance we trust will never be needed—but insurance which we would never forgive ourselves for foregoing in the event of catastrophe.”

— President Kennedy, in May 1961

Remove doors from their hinges and place them over supports



Drinking-water is required for survival. It is also useful as a shielding material. A collapsible children's swimming pool filled with water and located over the best corner of your basement will help improve the fallout protection. A bathtub, if suitably located, can also be used for this purpose.

**DEPARTMENT OF DEFENSE
OFFICE OF CIVIL DEFENSE**

Printed for the Cabinet. December 1954

The circulation of this paper has been strictly limited. It is issued
for the personal use of *Minister of Education*

TOP SECRET

Copy No.

C. (54) 389

UK NATIONAL ARCHIVES: CAB 129/72

*9th December, 1954***CABINET****FALL-OUT****MEMORANDUM BY THE MINISTER OF DEFENCE**

H. M.

*Ministry of Defence, S.W. 1,
7th December, 1954.*

EFFECTS OF THE EXPLOSION OF A THERMO-NUCLEAR BOMB

	Air Burst 10 M.T. at 20,000 feet (Radius in miles)	Ground Burst 10 M.T. (Radius in miles)
(a) Surface devastation to ordinary brick houses	7½	5½
(b) Devastation to facilities and tunnels below ground	Nil	½ mile in radius and depth
(c) Major structural damage to brick houses	9	6½
(d) Surface damage by fire on ordinary day	8-12	5-9

There will be an inner zone of approximately 270 square miles in area (larger than Middlesex), in which radiation will be so powerful that all life will be extinguished, whether in the open or in houses.

Outside this central zone, the density of radiation will diminish progressively with distance from the point of burst, but the rate of diminution in any particular direction depends on the prevailing wind. Within an area of about 3,000 miles, which with a steady 20-knot wind would be 170 miles long in the direction of the wind and over 20 miles wide in places, exposure in the open on the first day might easily be fatal. Rescue operations could commence on the outer fringes on the second day and thereafter proceed with gathering momentum but the greater part of the area would be immobilised for several days. Survival in this area depends on cover. The efficiency of the cover depends on the weight of the screening material. A thickness of 12 inches of earth would reduce the radiation dosage rate by a factor of about 15. Suitably screened shelter in an ordinary well-bricked house can reduce the dosage rate by a factor as high as 20.

There will be an outer area of 2,000-3,000 square miles in which there is a danger of radiation sickness if no precautions are taken. In general, it would be sufficient for people to stay indoors for about 12 hours after the onset of contamination.

Foreword

If the country were ever faced with an immediate threat of nuclear war, a copy of this booklet would be distributed to every household as part of a public information campaign which would include announcements on television and radio and in the press. The booklet has been designed for free and general distribution in that event. It is being placed on sale now for those who wish to know what they would be advised to do at such a time.

May 1980



Protect and Survive
ISBN 0 11 3407289

If Britain is attacked by nuclear bombs or by missiles, we do not know what targets will be chosen or how severe the assault will be.

If nuclear weapons are used on a large scale, those of us living in the country areas might be exposed to as great a risk as those in the towns. The radioactive dust, falling where the wind blows it, will bring the most widespread dangers of all. No part of the United Kingdom can be considered safe from both the direct effects of the weapons and the resultant fall-out.

The dangers which you and your family will face in this situation can be reduced if you do as this booklet describes.

Planning for survival

Stay at Home

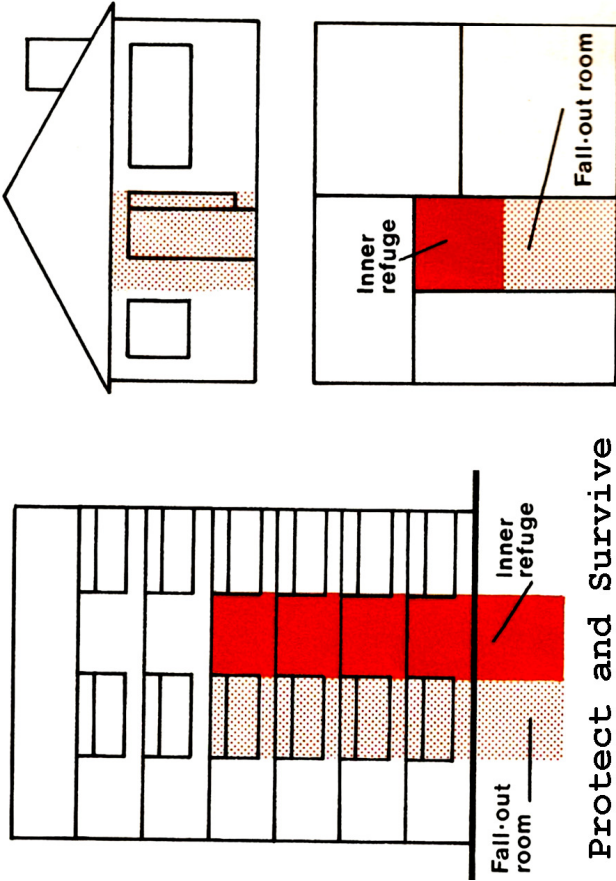
Your own local authority will best be able to help you in war. If you move away – unless you have a place of your own to go to or intend to live with relatives – the authority in your new area will not help you with accommodation or food or other essentials. If you leave, your local authority may need to take your empty house for others to use. So stay at home.

Plan a Fall-out Room and Inner Refuge

The first priority is to provide shelter within your home against radioactive fall-out. Your best protection is to make a fall-out room and build an inner refuge within it.

First, the Fall-out room

Because of the threat of radiation you and your family may need to live in this room for fourteen days after an attack, almost without leaving it at all. So you must make it as safe as you can, and equip it for your survival. Choose the place furthest from the outside walls and from the roof, or which has the smallest



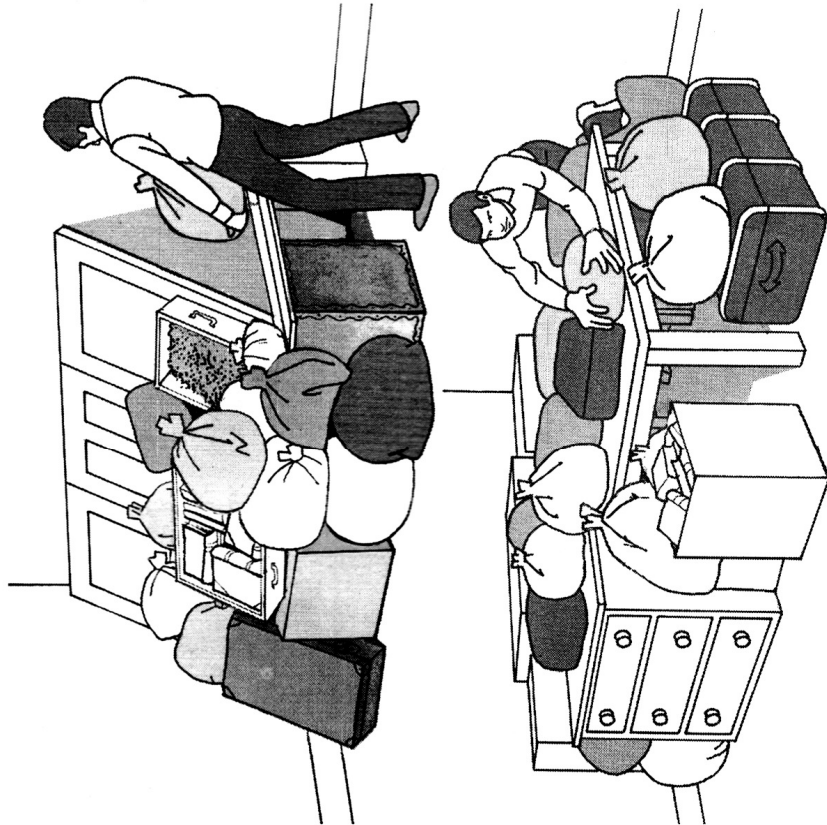
amount of outside wall. The further you can get, within your home, from the radioactive dust that is on or around it, the safer you will be. Use the cellar or basement if there is one. Otherwise use a room, hall or passage on the ground floor.

Now the Inner Refuge

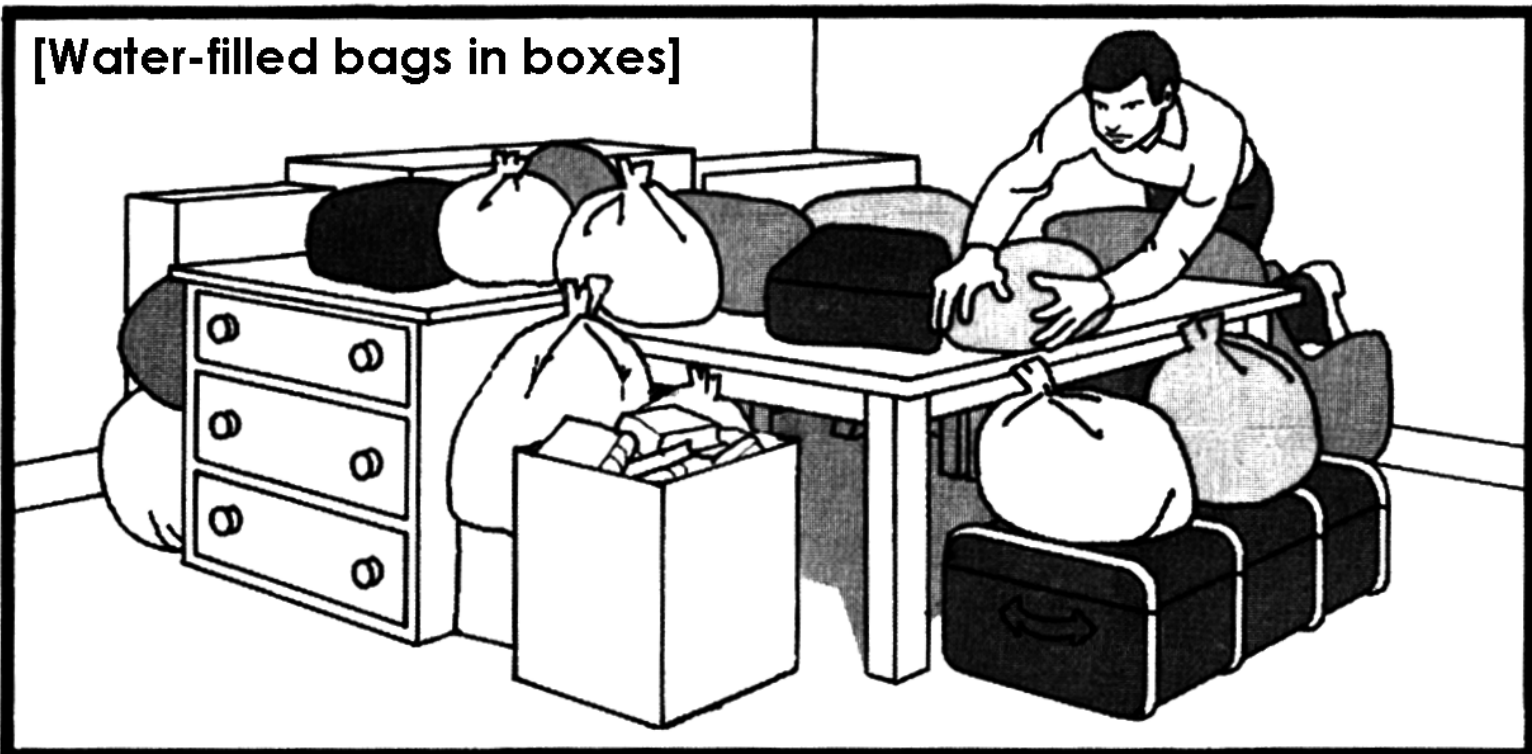
Still greater protection is necessary in the fall-out room, particularly for the first two days and nights after an attack, when the radiation dangers could be critical. To provide this you should build an inner refuge. This too should be thick-lined with dense materials to resist the radiation, and should be built away from the outside walls.

Here are some ideas:

Make a 'lean-to' with sloping doors taken from rooms above or strong boards rested against an inner wall. Prevent them from slipping by fixing a length of wood along the floor. Build further protection of bags or boxes of earth or sand – or books, or even clothing – on the slope of your refuge, and anchor these also against slipping. Partly close the two open ends with boxes of earth or sand, or heavy furniture.

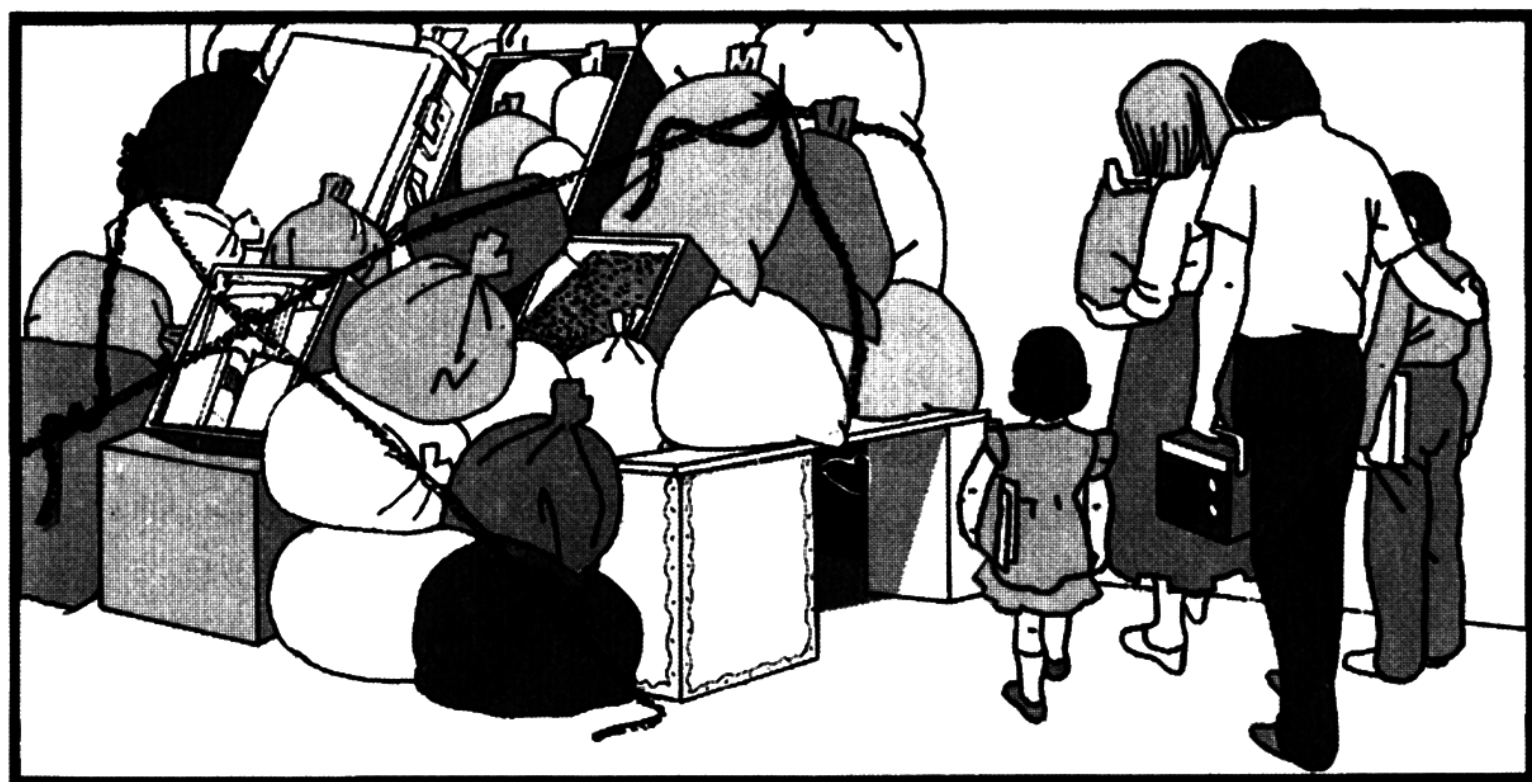


[Water-filled bags in boxes]



If there is structural damage from the attack you may have some time before a fall-out warning to do minor jobs to keep out the weather – using curtains or sheets to cover broken windows or holes.

If you are out of doors, take the nearest and best available cover as quickly as possible, wiping all the dust you can from your skin and clothing at the entrance to the building in which you shelter.





HOME OFFICE

CIVIL DEFENCE

Manual of Basic Training

VOLUME II

BASIC METHODS OF PROTECTION AGAINST HIGH EXPLOSIVE MISSILES

PAMPHLET No 5

LONDON: HIS MAJESTY'S STATIONERY OFFICE
1949

SIXPENCE NET

Domestic Shelters (for household use)

(a) **ANDERSON SHELTER.** This shelter was designed for erection outside the house. It consisted of 14 gauge corrugated steel sheets, steel angles, ties and channel irons. It was normally sunk about 3 ft. into the ground and covered over with earth to a minimum depth of 15 in., which, with the 14 gauge corrugated sheet gives the equivalent of 18 in. of earth.

The standard shelter was 6 ft. 6 in. by 4 ft. 6 in. by 6 ft. high. It was designed to shelter six persons, but was capable of being lengthened to accommodate eight, ten or twelve persons; or of being shortened to accommodate four persons.

Unless the entrance was screened (within 15 ft.) by a building or existing wall, a screen wall had to be provided. Trouble was sometimes experienced due to flooding by subsoil water in which case the below ground portion was tanked by a lining of cement concrete.

The shelter was, on occasions, erected on the surface, which involved casing it in cement concrete. The result was efficient but expensive.

(b) **MORRISON SHELTER.** This shelter was designed for use in a house and its chief function was to protect the occupants from being crushed by the collapse of the building. Protection against blast and fragments was provided by the walls of the house, which were sometimes specially thickened for this purpose.

It consisted of a steel table measuring 6 ft. 4 in. long by 3 ft. 10½ in. wide. It provided sleeping accommodation for two adults and a child, or a considerable number of small children in a sitting position, when used as a school classroom shelter.

(c) **STRUTTED REFUGE ROOM—STRUTTED BASEMENT.** The object of this form of shelter was the same as the Morrison shelter, i.e. to provide strutting to prevent the collapse of the room and to use the walls as protection against blast and fragments. Strutting was either steel or wood and the design and strength suited to the weight to be supported.

(d) **SMALL TRENCH OR SMALL SURFACE SHELTER IN GARDEN.** This type of shelter needs no special comment.

**Proceedings of the Symposium
held at Washington, D. C.**

April 19-23, 1965 by the

**Subcommittee on Protective Structures,
Advisory Committee on Civil Defense,
National Academy of Sciences—
National Research Council**

Protective Structures for

CIVILIAN POPULATIONS

1966

BLAST AND OTHER THREATS

Harold Brode
The RAND Corporation, Santa Monica, California

Chemical High-Explosive Weapons

As in past aerial warfare, bombs and missiles carrying chemical explosives to targets are capable of extensive damage only when delivered in large numbers and with high accuracy.

Biological Warfare

Most biological agents are inexpensive to produce; their effective dissemination over hostile territories remains the chief deterrent to their effective employment. Twenty square miles is about the area that can be effectively covered by a single aircraft; large area coverage presents a task for vast fleets of fairly vulnerable planes flying tight patterns at modest or low altitudes. While agents vary in virulence and in their biologic decay rate, most are quite perishable in normal open-air environments. Since shelter and simple prophylactic measures can be quite effective against biological agents, there is less likelihood of the use of biological warfare on a wholesale basis against a nation, and more chance of limited employment on population concentrations—perhaps by covert delivery, since shelters with adequate filtering could insure rather complete protection to those inside.

Chemical Weapons

Chemical weapons, like biological weapons, are relatively inexpensive to create, but face nearly insurmountable logistics problems on delivery. Although chemical agents produce casualties more rapidly, the greater amounts of material to deliver seriously limit the likelihood of their large-scale deployment. Furthermore, chemical research does not hold promise of the development of significantly more toxic chemicals for future use.

Radiological Weapons

The advantages of such modifications are much less real than apparent. In all weapons delivered by missiles, minimizing the payload and total weight is very important. If the total payload is not to be increased, then the inclusion of inert material to be activated by neutrons must lead to reductions in the explosive yield. If all the weight is devoted to nuclear explosives, then more fission-fragment activity can be created, and it is the net difference in activity that must be balanced against the loss of explosive yield. As it turns out, a fission explosion is a most efficient generator of activity, and greater total doses are not achieved by injecting special inert materials to be activated.

Perret, W.R., Ground Motion Studies at High Incident Overpressure, The Sandia Corporation, Operation PLUMBBOB, WT-1405, for Defense Atomic Support Agency Field Command, June 1960.

The Neutron Bomb

The neutron bomb, so called because of the deliberate effort to maximize the effectiveness of the neutrons, would necessarily be limited to rather small yields—yields at which the neutron absorption in air does not reduce the doses to a point at which blast and thermal effects are dominant. The use of small yields against large-area targets again runs into the delivery problems faced by chemical agents and explosives, and larger yields in fewer packages pose a less stringent problem for delivery systems in most applications. In the unlikely event that an enemy desired to minimize blast and thermal damage and to create little local fallout but still kill the populace, it would be necessary to use large numbers of carefully placed neutron-producing weapons burst high enough to avoid blast damage on the ground, but low enough to get the neutrons down. In this case, however, adequate radiation shielding for the people would leave the city unscathed and demonstrate the attack to be futile.

The thermal radiation from a surface burst is expected to be less than half of that from an air burst, both because the radiating fireball surface is truncated and because the hot interior is partially quenched by the megatons of injected crater material.

SUPERSEISMIC GROUND-SHOCK MAXIMA (AT 5-FT DEPTH)

Vertical acceleration: $\alpha_{vm} \approx 340 \Delta P_g / C_L \pm 30$ per cent. Here acceleration is measured in g's and overpressure (ΔP_g) in pounds per square inch. An empirical refinement requires C_L to be defined as the seismic velocity (in feet per second) for rock, but as three fourths of the seismic velocity for soil.

OUTRUNNING GROUND-SHOCK MAXIMA (AT ~10-FT DEPTH)

Vertical acceleration: $\alpha_{vm} \approx 2 \times 10^5 / C_L r^2$ + factor 4 or -factor 2. Acceleration is measured in g's, and r is the scaled radial distance—i.e., $r = R/W^{1/3}$ kft/(mt)^{1/3}.

Data taken on a low air-burst shot in Nevada indicate an exponential decay of maximum displacement with depth. For the particular case of a burst of ~40 kt at 700 ft, some measurements were made as deep as 200 ft below the surface of Frenchman Flat, a dry lake bed, which led to the following approximate decay law, according to Perret.

$$\delta = \delta_0 \exp(-0.017D),$$

where δ represents the maximum vertical displacement induced at depth D , δ_0 is the maximum displacement at the surface, and D is the depth in feet.

THE PROTECTION AGAINST FALLOUT RADIATION AFFORDED BY CORE SHELTERS IN A TYPICAL BRITISH HOUSE

Daniel T. Jones
Scientific Adviser, Home Office, London

Protective Factors in a Sample of British Houses (Windows Blocked)

Protective Factor	Percentage of Houses
< 25	36%
25-39	28%
40-100	29%
> 100	7%

"A very much improved protection could be obtained by constructing a shelter core. This means a small, thick-walled shelter built preferably inside the fallout room itself, in which to spend the first critical hours when the radiation from fallout would be most dangerous."⁽¹⁾

The full-scale experiments were carried out at the Civil Defense School at Falfield Park.⁽²⁾

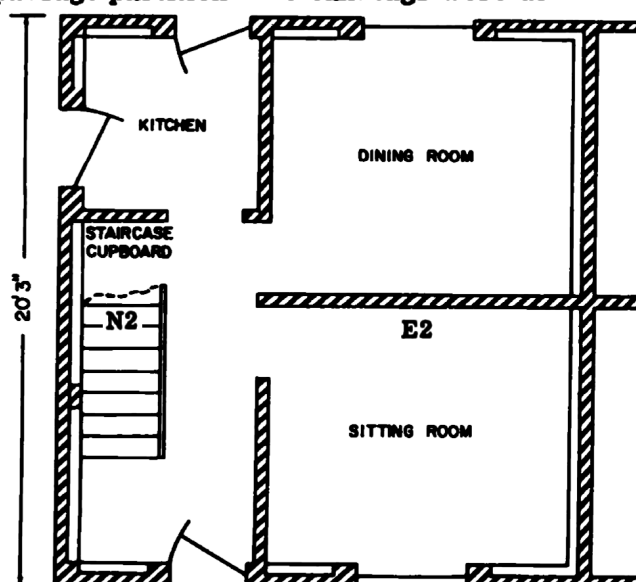
In the staircase construction, the shelter consisted of the cupboard under the stairs, sandbags being placed on treads above and at the sides.

A 93 curies cobalt-60 source was used.

1. Six sandbags per tread, and a double layer on the small top landing. 96 sandbags were used.

2. As (1), together with a 4-ft-high wall of sandbags along the external north wall. 160 sandbags were used.

3. As (2), together with 4-ft-high walls of sandbags along the kitchen/cupboard partition wall and along the passage partition. 220 sandbags were used.

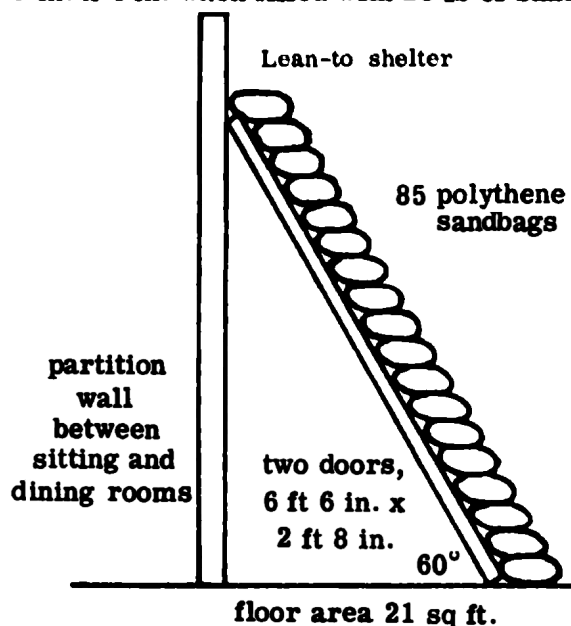


sandbags 24 in. x 12 in. when empty; 16 in. x 9 in. x 4 in. when filled with 25 lb of sand.

9 in. brick walls The windows and doors were not blocked	contribution r/hr/c/ft ²		Protective Factor	
	Position	Ground	Roof	
House only	E2	15.0	8.4	21
Lean-to	E2	10.4	2.4	39
Staircase cupboard:				
Stairs only sandbagged	N2	29.2	5.3	14
Stairs and outer wall sandbagged	N2	16.4	4.6	24
Stairs, outer wall, kitchen wall and corridor partition sandbagged	N2	8.8	1.8	47

1. Civil Defence Handbook No. 10, HMSO, 1963.

2. Perryman, A. D., Home Office Report CD/SA 117.



MODEL ANALYSIS

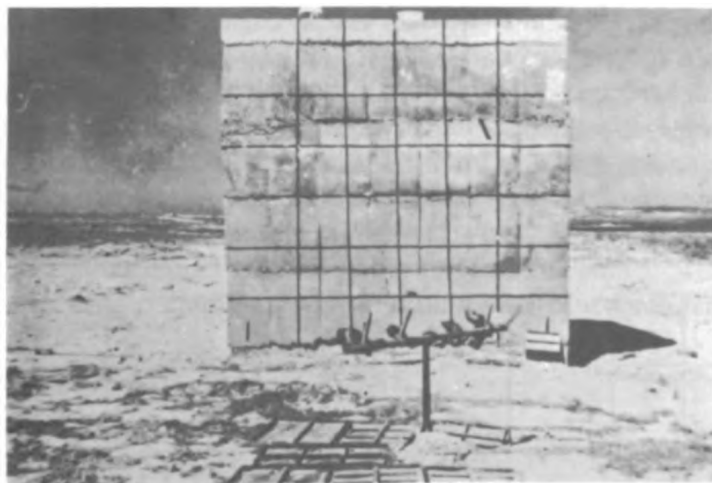
Mr. Ivor Ll. DAVIES
Suffield Experimental Station
Canadian Defense Research Board
Ralston, Alberta, Canada

Nuclear-Weapon Tests

In 1952 we fired our first nuclear device, effectively a "nominal" weapon, at Monte Bello, off north-west Australia. To the blast loading from this weapon we exposed a number of reinforced-concrete cubicle structures that had been designed for the dynamic loading conditions, and for which we made the best analysis of response we were competent to make at that time. Our estimates of effects were really a dismal failure. The structures were placed at pressure levels of 30, 10, and 6 psi, where we expected them to be destroyed, heavily damaged with some petaling of the front face, and extensively cracked, respectively. In fact, the front face of the cubicle at 30 psi was broken inwards; failure had occurred along both diagonals, and the four triangular petals had been pushed in. At the 10-psi level, where we had three cubicles, each with a different wall thickness (6, 9, and 12 in.), we observed only light cracking in the front face of that cubicle with the least thick wall (6 in.). The other two structures were apparently undamaged, as was the single structure at the 6-psi level.

In 1957, the first proposals were made for the construction of the underground car park in Hyde Park in London. The Home Office was interested in this project since, in an emergency, the structure could be used as a shelter. Consequently a request was made to us at Atomic Weapons Research Establishment (A.W.R.E.) to design a structure that would be resistant to a blast loading of about 50 psi, and to test our design on the model scale.

Using the various load-deformation curves obtained in this test, an estimate was made of the response of the structure to blast loading. Of particular interest was the possible effect of 100 tons of TNT, the first 100-ton trial at Suffield in Alberta.



10 p.s.i.



34 p.s.i.

Dynamic tests, Monte Bello cubicles.

A total of seven more models was made; six were shipped to Canada and placed with the top surface of the roof flush with the ground and at positions where peak pressures of 100, 80, 70, 60, 50, and 40 psi were expected. The seventh model was kept in England for static testing at about the time of firing. The results were not as expected. In the field, the four models farthest from the charge were apparently undamaged; we could see no cracking with the eye, nor did soaking the models with water reveal more than a few hair cracks. The model nearest the charge was lightly cracked in the roof panels and beams, and one of the columns showed slight spalling at the head. This model had been exposed to a peak pressure of 110 psi.

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Davies, I., SES 100 Ton TNT Trial - Suffield, Alberta, August 1961; Performance Test on Model Garage-Shelter Roof System, AWRE Report No. E2/63, United Kingdom Atomic Energy Authority, Atomic Weapons Research Establishment, Aldermaston, Berkshire, March 1963.

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Keller, J.A., A Study of World War II German Fire Fatalities, DC-TN-1050-3, prepared for Office of Civil Defense by Dikewood Corporation, Albuquerque, NM, April 1966.

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- exaggerates blast effects by ignoring ground friction

Longinow, A., Survivability in a Nuclear Weapon Environment (Final Report), IITRI Project No. J6427 (AD-A076026), prepared for Defense Civil Preparedness Agency by IIT Research Institute, Chicago, IL, May 1979. - exaggerates blast effects by ignoring ground friction

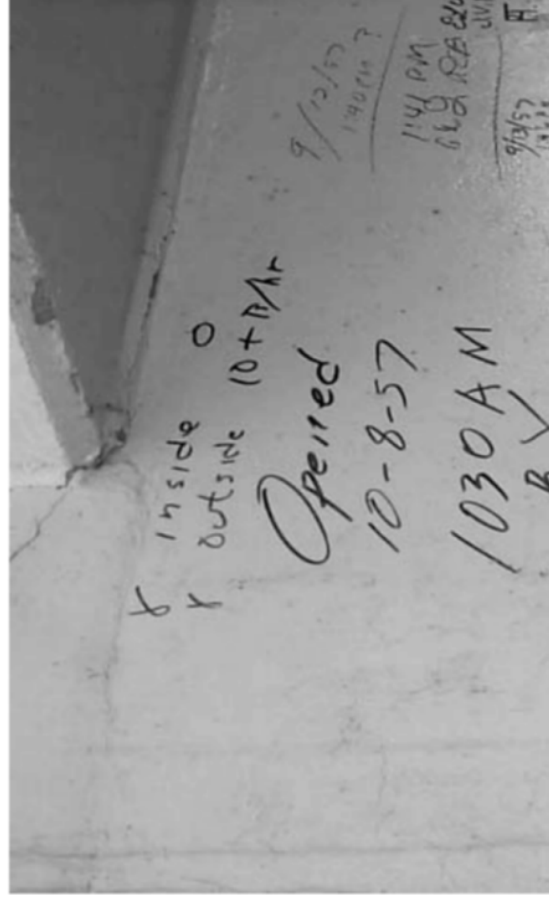
Ground Zero 29 kt APPLE-2 on 500 ft tower May 5, 1955
Tower legs are blown down, not vaporized or even melted



APPLE-2 - Robert L. Corsbie (Director), left and Fred Wilson (Assistant Director)



Shelter at ground zero, directly under 11 kt Fizeau nuclear explosion (500 ft tower)

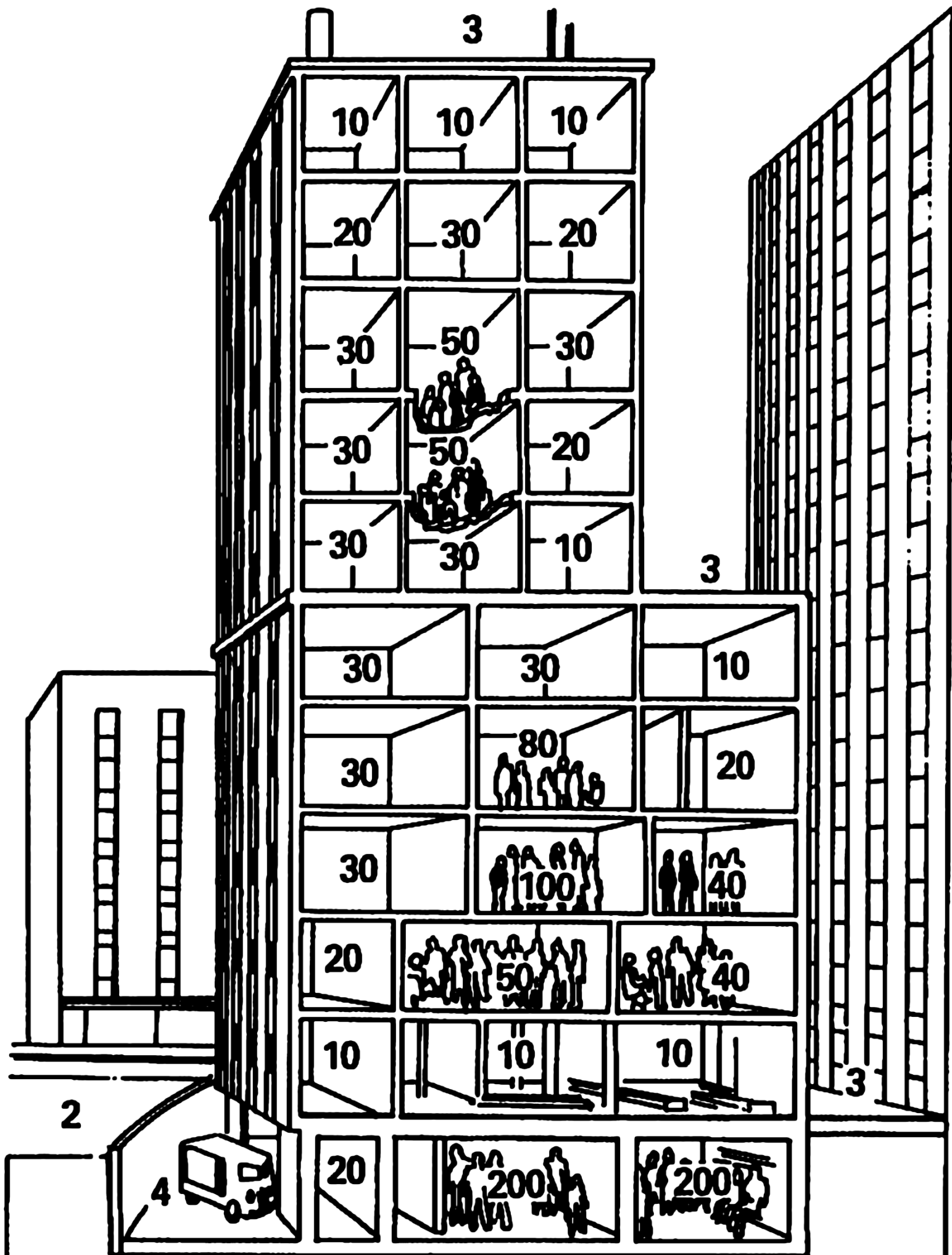


Test fired on 14 September 1957. Shelter was re-entered on 8 October 1957 when outdoor (ground zero) dose rate was down to about 10 R/hr. No fallout entered the concrete shelter, which was protected by a steel dome hatch (above left). Shelter had 5 feet of earth cover, and was depressed 2 feet into the ground by the shock wave. (W. G. Johnson, A Historical Evaluation of the T-3b Fizeau Bunker.)

TRINITY GROUND ZERO:
8000 R/hr at 1 hour

1.4 R/hr at
57 days
11 Sept. 1945





Radiation protection factors in modern city buildings
DCPA Attack Environment Manual, ch. 6, panel 18

RADIOACTIVE FALL-OUT HAZARDS FROM SURFACE BURSTS OF
VERY HIGH YIELD NUCLEAR WEAPONS

by

D. C. Borg
 L. D. Gates
 T. A. Gibson, Jr.
 R. W. Paine, Jr.

MAY 1954

HEADQUARTERS, ARMED FORCES SPECIAL WEAPONS PROJECT
 WASHINGTON 13, D. C.

e. Passive defense measures, intelligently applied, can drastically reduce the lethally hazardous areas. A course of action involving the seeking of optimum shelter, followed by evacuation of the contaminated area after a week or ten days, appears to offer the best chance of survival. At the distant downwind areas, as much as 5 to 10 hours after detonation time may be available to take shelter before fall-out commences.

f. Universal use of a simply constructed deep underground shelter, a subway tunnel, or the sub-basement of a large building could eliminate the lethal hazard due to external radiation from fall-out completely, if followed by evacuation from the area when ambient radiation intensities have decayed to levels which will permit this to be done safely.

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Table II

Total Isodose Contour: 500r from Fall-out to H+50 Hours

<u>Yield (MT)</u>	<u>15</u>	<u>1</u>	<u>10</u>	<u>60</u>
Downwind extent (mi)	180	52	152	340
Area (mi ²)	5400	470	3880	17,900

Analysis of Sheltering and Evacuation Strategies for an Urban Nuclear Detonation Scenario

Larry D. Brandt, Ann S. Yoshimura

Executive Summary

A nuclear detonation in an urban area can result in large downwind areas contaminated with radioactive fallout deposition. Early efforts by local responders must define the nature and extent of these areas, and advise the affected population on strategies that will minimize their exposure to radiation. These strategies will involve some combination of sheltering and evacuation actions. Options for shelter-evacuate plans have been analyzed for a 10 kt scenario in Los Angeles.

Results from the analyses documented in this report point to the following conclusions:

- When high quality shelter (protection factor ~ 10 or greater) is available, shelter-in-place for at least 24 hours is generally preferred over evacuation.
- Early shelter-in-place followed by informed evacuation (where the best evacuation route is employed) can dramatically reduce harmful radiation exposure in cases where high quality shelter is not immediately available.
- Evacuation is of life-saving benefit primarily in those hazardous fallout regions where shelter quality is low and external fallout dose rates are high. These conditions may apply to only small regions within the affected urban region.
- External transit from a low quality shelter to a much higher quality shelter can significantly reduce radiation dose received if the move is done soon after the detonation and if the transit times are short.

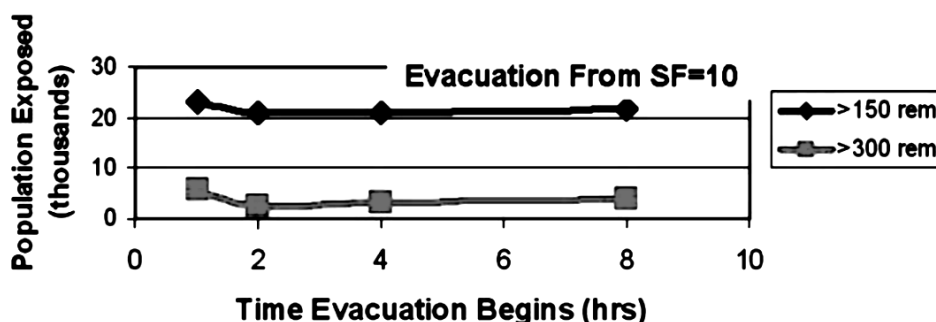


Figure 12. Departure time sensitivities for informed evacuations from shelters with SF=4



A REPORT

BY THE UNITED STATES ATOMIC ENERGY COMMISSION ON THE EFFECTS OF HIGH-YIELD NUCLEAR EXPLOSIONS

FALLOUT PATTERN OF 1954 TEST IN THE PACIFIC

19. Data from this test permits estimates of casualties which would have been suffered within this contaminated area if it had been populated. These estimates assume: (1) that the people in the area would ignore even the most elementary precautions; (2) that they would not take shelter but would remain out of doors completely exposed for about 36 hours; and (3) that in consequence they would receive the maximum exposure. Therefore, it will be recognized that the estimates which follow are what might be termed extreme estimates since they assume the worst possible conditions.

PROTECTION AGAINST FALLOUT

26. In an area of heavy fallout the greatest radiological hazard is that of exposure to external radiation. Simple precautionary measures can greatly reduce the hazard to life. Exposure can be reduced by taking shelter and by utilizing simple decontamination measures until such times as persons can leave the area. Test data indicate that the radiation level, i.e., the rate of exposure, indoors on the first floor of an ordinary frame house in a fallout area would be about one-half the level out of doors. Even greater protection would be afforded by a brick or stone house. Taking shelter in the basement of an average residence would reduce the radiation level to about one-tenth that experienced out of doors.

29. If fallout particles come into contact with the skin, hair or clothing, prompt decontamination precautions such as have been outlined by the Federal Civil Defense Administration will greatly reduce the danger. These include such simple measures as thorough bathing of exposed parts of the body and a change of clothing.

30. If persons in a heavy fallout area heeded warning or notification of an attack and evacuated the area or availed themselves of adequate protective measures, the percentage of fatalities would be greatly reduced even in the zone of heaviest fallout.

NUMBER AND CLASSIFICATION OF OFFICIAL EVACUEES IN GREAT BRITAIN IN 1939 AND 1940

	SEPTEMBER, 1939		JANUARY, 1940
	Number	Percentage Distribution	Number
900,000 of the 1.5 million returned to the target areas after four months of war.			
1. Unaccompanied school children.....	826,959	56.1	457,600
2. Mothers and accompanied children....	523,670	35.5	64,900
3. Expectant mothers.....	12,705	0.9	1,140
4. Blind persons, cripples, and other special classes.....	7,057	0.5	2,440
5. Teachers and helpers.....	103,000	7.0	46,500
Total.....	1,473,391	100.0	572,580
			39

Source: R. M. Titmuss, *Problems of Social Policy* (London: H.M. Stationery Office, 1950), pp. 103 and 172.

Effectiveness of Some Civil Defense Actions in Protecting Urban Populations (u)

Appendix B of Defense of the US against Attack by Aircraft and Missiles (u)

ORO-R-17, Appendix B

ORO-R-17 (App B)

~~CONFIDENTIAL~~

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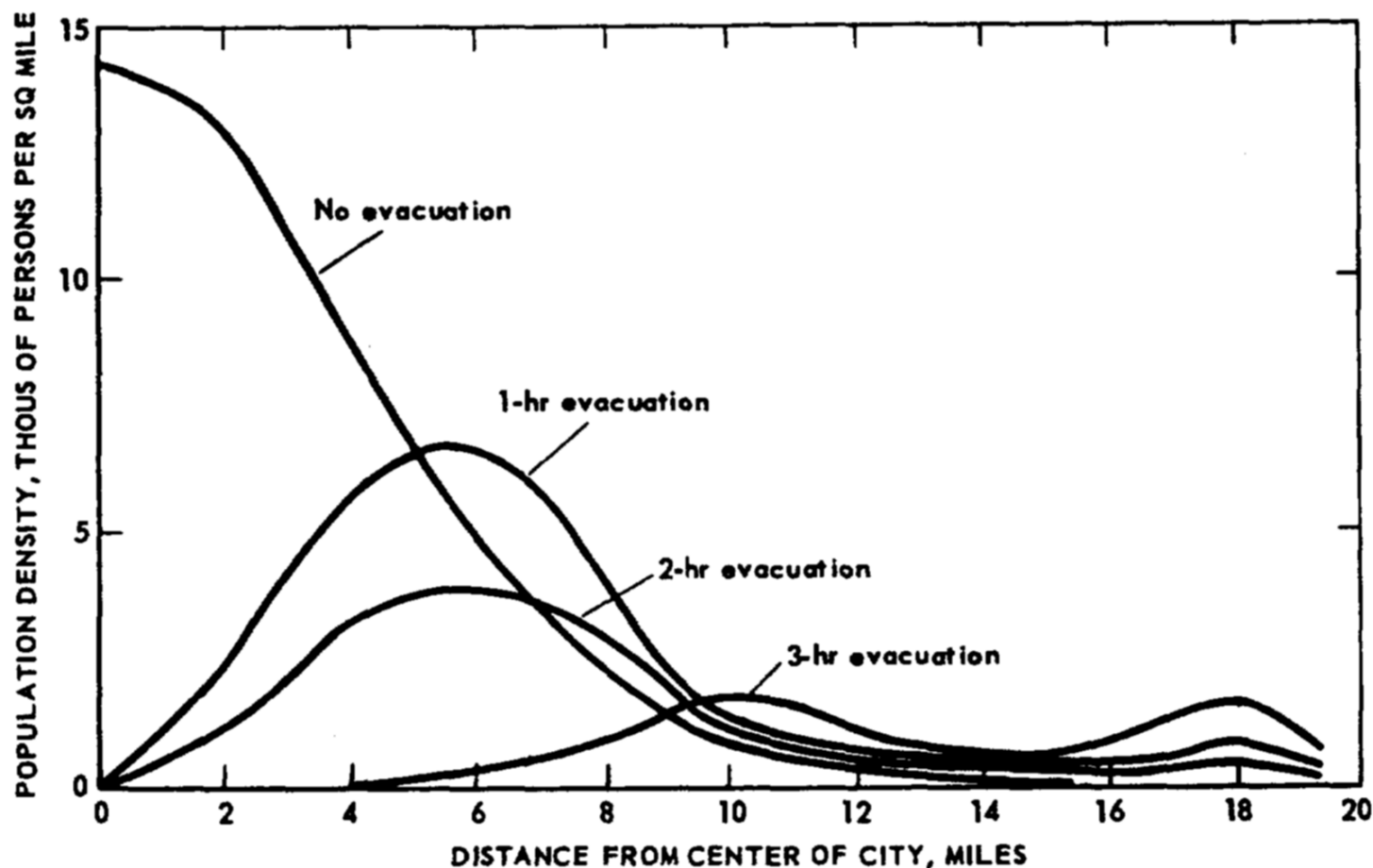


Fig. 10 — Population Density of Washington Target as Function of Distance from Center of City for Three Evacuation Times

NONMILITARY DEFENSE FOR THE UNITED STATES
STRATEGIC, OPERATIONAL, LEGAL AND CONSTITUTIONAL ASPECTS

William K. Chipman

A publication of the National Security Studies Group
at the University of Wisconsin,
Madison, Wisconsin, May, 1961.

In Britain, by early 1940, the government had issued free, to families of low income, some 2.3 million bomb shelters, enough to shelter over one-fourth of the population. But by the same time -- after Munich had brought home to the British people the peril in which they stood, even after the war had begun -- less than 1000 shelters had been purchased. This was under 0.04 per cent of the total number in place, despite the fact that the shelters were sold at cost.⁷

For protection against chemical and biological attack, our National Plan proposes that protective (gas) masks be made "...available to the people through regulated commercial distribution..."⁸ or in a word, sold. That too is nonsense. In Britain, in contrast, the government had decided by 1935 that it would be futile to expect the population to buy their own masks. During the Munich crisis, 38 million gas masks were issued free to the people of Great Britain.⁹ The British government of that time could scarcely be called war-minded or over-prepared for war. Still less, it appears, are we prepared in 1961.

7. O'Brien, Terence H., Civil Defence, London, HMSO, 1955 at 335. In 1939 the government had decided to issue Anderson (corrugated steel) shelters free to householders with incomes of not over £ 250 a year. Id., 188.
8. OCDM National Plan, Annex 24, "National Biological and Chemical Warfare Defense Plan," at 6.
9. O'Brien, op. cit. supra note 7 at 165.

-- The Argument That Increased Spending for Nonmilitary and Other
Defenses May Cause an Economic Decline

A celebrated statesman not many years ago elegantly put (or rather, asserted) the argument for "national bankruptcy":

CHAMBERLAIN
IN LATE 1936
WHEN
CHANCELLOR
OF THE
EXCHEQUER

If we were now to follow [X's] advice and sacrifice our commerce to the manufacture of arms, we should inflict a certain injury on our trade from which it would take generations to recover, we should destroy the confidence which now happily exists, and we should destroy the revenue....³³

And, a comment on that argument,

It was held very strongly that financial stability was our fourth, and final, military arm, that we must balance [the national budget], and avoid interference... with trade....³⁴

The statement quoted was not made in 1949, when not muscle but fat was being pared from our military budgets. It was not made in 1955 or 1960. It was made, rather, in the 1930's. The statesman who so anxiously viewed the dangers to be apprehended from increased expenditure for arms was Neville Chamberlain. "X" was Winston Churchill. Britain was, if not "generations," at any rate half a generation in paying the bill for Chamberlain's economics. Only recently have her trade, revenue and financial stability recovered from the economies of Stanley Baldwin and Neville Chamberlain.

33. Feiling, Keith, The Life of Neville Chamberlain, London, Macmillan, 1946 at 314. Quotation reproduced by kind permission of the author, MacMillan & Company Ltd. and St. Martin's Press, Inc.

34. Id. at 316.

--The Question of Public Apathy--British Experience Before World War II Compared

The view is often expressed that the population is apathetic, or even hostile, towards nonmilitary defense, and that nothing can be done to develop these defenses until public apathy changes to concern. This view was succinctly put by a member of the House committee which passes on budget requests for OCDM. He said in March, 1959, that, "The Congress is not going to shove something down the throats of the people that they are not interested in. If you did, the Members of Congress would not be here very long."⁴⁶

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A nation-wide opinion survey by the Institute for Social Research of the University of Michigan, made in 1957, revealed, among other things, that 68 per cent of the population favored planning to evacuate cities, and that 90 per cent favored constructing shelters for people who lived in areas that might be attacked.⁴⁷

Whatever the present reaction of the public might be to a program for nonmilitary defense, it is nearly certain that after a frightening crisis had occurred, the public would not only demand these programs, but would be highly critical of a government which had not taken the necessary action. This, at least, was the experience in Britain.

Munich, however, changed all that. War seemed so imminent that the government ordered day and night digging on trenches in parks and open areas. It issued gas masks to some 38 million citizens.⁵⁰ Then, when fitting gas masks and digging trenches had given the citizens personal proof of the threat which hung over them, "Fatalism about providing effective protection against air attack was...replaced by a feeling that this could be done, if the authorities showed enough will and energy."⁵¹

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46. U.S. House, Committee on Appropriations, Hearings, Independent Offices Appropriations, 1960, 86th Cong., 1st Sess. (1959) at 486.

47. Pohlenz, D. Dean, "Problems of Civil Defense Preparedness -- A Policy for Today," Washington, Industrial College of the Armed Forces Student Exercise M57-83 (1957) at 33.

49. O'Brien, Terence H., History of the Second World War: Civil Defence, London, HMSO, 1954 at 93, 99 and 104.

50. Id. at 161 and 165.

51. Id. at 166.

Bertrand Russell, for example, wrote in 1959 that,

On the most favourable hypothesis, [the postwar world] would consist of destitute populations, mad-dened by hunger, debilitated by disease...incapable of supporting educational institutions, and rapidly sinking to the level of ignorant savages. This, I repeat, is the most optimistic forecast which is in any degree plausible.⁶¹ [Emphasis added.]

This notion of the extinction of civilization, or even of all life, is a comforting one.⁶³ Most important, it ensures that a nuclear war will never be fought, since no sane (or perhaps even moderately insane) national leader would consider thermonuclear war as an instrument of policy. Also, if there is really nothing that can be done to mitigate the effects of nuclear war, rational men need not trouble themselves about the problems of preparing nonmilitary defenses -- or of paying for them.

The theory that thermonuclear war automatically results in world annihilation has had, and still has, some highly respectable adherents. In 1955, for example, fifty-two Nobel laureates subscribed to the statement that unless all nations renounced the use of force, they would simply "...cease to exist."⁶⁴ Writers on disarmament in 1961 continue to point out that it would be impossible to "...protect [civilians not killed by the initial attack on cities] against fallout and starvation,"⁶⁵ and that "Proponents of the arms race are willing to risk the destruction of civilized society...."⁶⁶

--The View That National Security Can Best Be Achieved by Buying Only Offensive and Active Defensive Weapons

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61. Russell, Bertrand, Common Sense and Nuclear Warfare, London, copyright (C) 1959 by George Allen and Unwin, Ltd., quotation reproduced by kind permission of Simon and Schuster, Inc. The notion of mutual extermination is also alluded to at 32, and the survivors are characterized as starving and debilitated at 26.
62. On Thermonuclear War, 35.
63. Id. at 11.
64. Id. at 9. Compare Bertrand Russell's views, supra note 61.
65. Sohn, Louis B., "Security Through Disarmament," 192 The Nation 159-163 at 159 (February 25, 1961).
66. Melman, Seymour, "The 'Arms-Control' Doctrine," 192 The Nation 114-116 at 116 (February 11, 1961).

Clark, Grenville and Louis B. Sohn, World Peace Through World Law (2d ed.), Cambridge, Massachusetts, Harvard University Press, 1960.

-- The Argument That Nonmilitary Defense Would Destabilize the Balance of Terror

To take any steps to protect the population would be to do them a dis-service, since it might make war "thinkable" again. And whatever steps were taken, millions or tens of millions would be sure to die.

A variant of the hostage theory is that if we were to embark on a serious program for nonmilitary defense, we should inescapably spread war-mindedness among the American people.⁷¹ Once they were awakened to the possibility, or worse the "thinkability," of war, they would inevitably become more hostile towards the source of the danger, namely, the USSR. They might then be expected, with the American penchant for grasping nettles (those, at any rate, recognized as nettles), to press for a first strike against the Soviet Union.

But other countries, not least the Soviet Union, do have non-military defense programs of substantial value.

It is not, in any case, self-evident that a nonmilitary defense program would have a destabilizing (or unbalancing) effect upon American psychology. If anything, a program which included, for example, building fallout shelters or issuing radiation meters, might, by bringing home the threat of war to the American people in a highly personal way, incline them rather to a sober and pacific than to a war-like psychology. City dwellers might reflect upon the fact that their shelters, at least under any program the United States is likely to undertake in the next five years, would give them not a certainty but only a fair to good chance of survival. Rural residents might reflect upon the prospect of an incursion of refugees from the cities.

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71. Letter from Dean David F. Cavers, Harvard Law School, New York Times, March 20, 1960, page 10E, column 6. See too Brown, Harrison and James Real, Community of Fear, Santa Barbara, California, Center for the Study of Democratic Institutions, 1960.
-

This whole problem of psychological response to nonmilitary defense clearly requires detailed study by experts. British experience in the Munich and post-Munich period may not be without relevance.⁷³

--Would A Nonmilitary Defense Program Injure Prospects for Arms Control?

Finally, there is the question whether a program for nonmilitary defense is compatible with plans for arms control or even disarmament.

the reverse, it should not hazard the success of any arms control or disarmament negotiations in which the Soviets are seriously interested, and it would stabilize any arms control agreement that might be concluded.

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73. See, for example, O'Brien, op. cit. supra note 49 at 329 on response to the anti-gas program, and Titmuss, Richard M., Problems of Social Policy, London, HMSO, 1950 at 29-39 on response to evacuation plans and programs.

Thermonuclear war is a grisly topic. It is, however, one about which we would do well to think. The argument might be made that research on war may make it somewhat more likely to occur. It is more probable, however, that the reverse is true, that not thinking about thermonuclear war may make it easier to blunder into one -- or what might be even worse, to lose one.

It would be well indeed if nuclear war would be unmistakably so annihilating as to be unthinkable, at least for sane men, as Bertrand Russell and others hold. But it would be unfortunate if this view prevailed only in the West and not in Moscow and Peiping. There is good evidence that it does not, especially in the latter. There is in any case something of schizophrenia about spending tens of billions each year on thermonuclear weapons and their delivery vehicles and then refusing to think about the ways and conditions in which they might be used, or (more hopefully) the ways in which we can best assure, short of surrender, that they will not be used.

The best study to date is Herman Kahn's On Thermonuclear War, published late in 1960.⁷⁷ Most of what follows in this chapter draws heavily upon Kahn's work, though it is impossible to do it justice in so

small a space. He analyzes, so far as possible in a quantitative way, the probable or possible causes, courses and effects of thermonuclear wars which might occur in the next decade. Kahn's work has been bitterly attacked, although to date in no very temperate or reasoned fashion. It has been called "a moral tract on mass murder," "permeated with a blood-thirsty irrationality," and its quantitative approach a "Higher Incoherence."⁷⁸ It has been said to show "narrowness of vision," and to have about it an "air of unreality."⁷⁹ But coherent criticism, reasoned rather than stated, marked by broadness of vision or an air of reality, has yet to appear, certainly in more than fragmentary form.⁸⁰

77. Kahn, Herman, On Thermonuclear War, Princeton, N.J., Princeton University Press, 1960. On U.S. national strategy see too Rowen, op. cit. supra note 36, and Washington Center of Foreign Policy Research, Johns Hopkins University, Study for Senate Committee on Foreign Relations, Developments in Military Technology and Their Impact on United States Strategy and Foreign Policy, 85th Cong., 1st Sess. (Comm. Print 1959).
78. Newman, James R., "A Moral Tract on Mass Murder," The Washington Post, February 26, 1961, page E7, columns 5-8. The level of coherence of Mr. Newman's critique is best left unstated.
79. Wolff, Robert Paul, "The Game of War," 144 The New Republic (February 20, 1961) 9-13.
80. The usual criticism of Kahn's work is that it does not sufficiently take into account political problems. Careful, or even casual, reading of On Thermonuclear War, however, shows that Kahn has a better grasp of political problems than most of his political-scientist critics have of strategy.

We may expect Soviet or Chinese support for "progressive, revolutionary national liberation wars"⁸³ in such areas as Algeria or the Congo. We may see guerilla action in Southeast Asia or other areas on the periphery of the "Socialist camp." We may even see limited wars, fought without or perhaps even with tactical nuclear weapons. Soviet missiles may be rattled again, as they have been rattled on behalf of Nasser and Castro. (American missiles might also be rattled, though this seems unlikely during the next few years, at least.) Finally, even negotiations for arms control or disarmament may be devices of cold war conflict, as they have too largely been to date.

What Are We Trying to Deter?

Kahn points out that it is critically important to distinguish between deterring an attack upon the United States and attacks or major provocations at other points, for example, a "squeeze" or even armed attack on Berlin. The same weapons, dispositions of weapons, and strategies do not suffice for both ends.

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83. This was promised in the manifesto issued by the leaders of 81 Communist parties after their meeting in Moscow in late 1960. New York Times, December 7, 1960, pages 14 to 17, with the "progressive revolutionary significance" of "national-liberation wars" noted at page 17, column 7. Premier Khrushchev also adverted to the inevitability of "national liberation wars" in a report delivered January 6, 1961. New York Times, January 19, 1961, page 6, column 4.
84. Berlin was noted as a "seat of international provocation" in the late-1960 manifesto. New York Times, December 7, 1960, page 15, column 2. (Any Western posture other than abject surrender is doubtless "provocative" in the communist lexicon.)

As Kahn has put it, history has a disconcerting way of being "...richer and more imaginative than any scholar."⁸⁶

86. On Thermonuclear War at 557.

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It is a fearsome thing to contemplate the risk of 10 or 20 or 120 million Americans, or Americans and Britons, being killed in a war, for example, over two and one-half million West Berliners.

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--Devices to Tide Us Over the Earlier 1960's

The Soviets might not, of course, decide to risk everything, or at any rate a great deal of capital and some millions of their citizens, on our succumbing to postattack coercion. If the Marxist-Leninist dialectic condemns spurning the opportunities offered by history, it also condemns taking excessive risks, a sin termed "adventurism."¹⁰⁹ What can we do to increase the risks to be apprehended from an attack on the United States?

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109. See, for example, Garthoff, Raymond, Soviet Strategy in the Nuclear Age, New York, Praeger, 1958 at 5.

--A \$100 Billion Program Including Blast Shelters and Extensive Preparation for Economic Recuperation

The "splendid," \$100 billion or more, program is the one which might raise some reasonable Soviet apprehension that we might strike first. This program, including blast shelters into which the urban population could "duck" in a matter of twenty or thirty minutes, would in fact be part of a credible strategic posture allowing us to make a first strike.

(Expensive deep shelters create "Maginot Line" delusions: Hitler simply adapted plans to go around obstructions. Similarly, shelters in Hiroshima were unoccupied due to surprise attack! If you have deep shelters, an enemy will plan surprise attack. It takes 20 min to get into shelters, but only 3 minutes for SLBM submarine missile attack from offshore!)

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--History and Arms Control

The lessons of history, for what they may be worth, include those of 1914, when Europe stumbled into a major war which no power wanted, as a result of a minor war about which only Austria or Serbia were really serious. As Herman Kahn has pointed out, there are disturbing analogies between the years before 1914 and those in which we now live.¹⁵⁸

(Wrong: the German Kaiser did WANT war and had been planning since 1912 to use any excuse for starting war, implementing Schlieffen's plan!)

--Arms Control for the 1960's

At all events, it is clear that the problems of arms control must have more intelligent, more intensive, and more sustained attention than they have yet had, if we are to avoid repeating something like the disasters of either 1914 or 1933-1939. Views on the approaches required, as noted above, vary widely.

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158. Kahn, On Thermonuclear War 368-370.

It would plainly be futile, in view of the vigorous Soviet pacification of Hungary, or of the Chinese liberation of Tibet, to rely upon "world opinion" (whatever that is) to deter violations. . . .

One sanction might be the prospect of a renewed arms race, triggered by the discovery of violations. But this might not deter cheating, particularly if the party bent on violation believed it could secure a commanding position before the injured party could catch up. (Here we might remember the belated but futile efforts of the British to regain air parity, after Hitler's rapid expansion of the Luftwaffe.)¹⁷⁶

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176. See, for the history of that dismal episode in the history of the West, Sir Winston Churchill's The Gathering Storm, chapter 7. Kahn points out that if one side obtained a significant lead because of evasion or rapid rearmament after the agreement broke down, it might then "...feel compelled to perform a great public service by arranging to stop the arms race before a dangerous balance of terror was restored. It could do this most reliably by stopping the cause of the arms race -- its opponent. Most writers ignore this situation...." On Thermonuclear War at 230.

Is Nonmilitary Defense Possible?

If nonmilitary defense is necessary, is it possible? In the discussion to this point, it has been assumed that it is. But can one say, with any measure of confidence, that nonmilitary defenses could in fact ensure the survival of most or all of the population? Even if a shelter program could preserve the lives of most Americans against fallout or even blast, would they emerge into a world worth living in, or indeed, possible to live in? What of the genetic effects of war? Would all children be born deformed? What of leukemia, of cancer, or of a shortened span of life? What of strontium-90? What of the standard of living? Would the survivors, and their descendants, be reduced to grubbing out a wretched existence, with our economy shattered beyond hope of repair? What of the social impact of attack? Could we expect that the survivors, as Bertrand Russell has predicted, would "rapidly sink to the level of ignorant savages"?

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Further, nonmilitary defense must be designed to cope with widely varying conditions. The nature of the postattack environment would depend upon the weight and pattern of the enemy's attack--which might in turn be influenced by the nonmilitary defense measures we had taken. The areas contaminated by fallout would of course be determined by the winds prevailing on the day of attack, as well as by the enemy's attack pattern. Anti-aircraft and antimissile defenses would also affect the nature of the post-attack environment.

The major systems analyses of nonmilitary defense so far published are the Rand Report and a more detailed work done by Mr. John Devaney's OCDM Operations Research Office, A Preliminary Analysis of Non-Military

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Defense.¹⁸⁶ Both of these studies give some ground for sober confidence that the United States could survive thermonuclear wars in the 1960's and even beyond, given appropriate levels of nonmilitary defense preparation. But much more detailed research remains to be done. There are still major areas of uncertainty in the performance of nonmilitary defense systems. The principal policy suggestion of the Rand study was therefore that the United States undertake a broad program of research and development on nonmilitary defense problems, to cost some \$200 million over two or three years.¹⁸⁷

186. OCDM, A Preliminary Analysis of Non-Military Defense, Battle Creek, Michigan, 1959.

187. Kahn, Herman, et al., R-322-RC 184 at 44. (This is about fifty times the present OCDM annual research appropriation.)

R-322-RC Rand Corporation Report on a Study of Non-Military Defense

Even if fallout at first decays rapidly, so that fallout shelters could protect most of the population from immediate death or illness due to radiation, would the longer-term effects of radiation make life as we know it either impossible or insupportable for the survivors? Despite the rapid initial decay of fallout, a relatively small amount of contamination would remain in the environment for a long time. This would include strontium-90, a long-lived isotope produced by nuclear fission.

The Rand Report states that about four per cent of babies are at present stillborn or die shortly after birth, two per cent are malformed and two per cent develop later troubles attributable to genetic defects.²⁰⁰ If as the result of nuclear war, both parents had been exposed to about 250 roentgens, spread over a long period, their chances of producing a seriously defective living child might increase from four per cent to five per cent.²⁰¹

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199. Testimony of Dr. James F. Crow, Professor of Genetics, University of Wisconsin, in 1957 fallout hearings, op. cit. supra note 193 at 1013. More recent experiments show that there is a possibility that radiation received over an extended period may not have as much genetic effect as radiation received over a short period. U.S. Congress, Joint Committee on Atomic Energy, Hearings, Fallout from Nuclear Weapons Tests, 86th Cong., 1st Sess. (1959) at 1566.

200. Kahn, et al., op. cit. supra note 184 at 16.

201. Kahn, On Thermonuclear War at 46.

Strontium-90, produced by fission, falls out over crop and pasture lands, is taken up by plants, and can eventually find its way into human bones, where it may cause bone cancer or, in smaller amounts, cause bone lesions and interfere with bone growth, particularly in children.²⁰⁴

204. See generally Kahn, On Thermonuclear War at 63-72.

All of these long-term effects of nuclear war are serious, particularly the strontium-90 problem. It appears, however, that with proper preparation, it should be possible to alleviate them. In chapter 2 the subject of decontamination, or removal of radioactive debris, is discussed. In chapter 3 is discussed a scheme suggested by Herman Kahn to ensure that relatively contaminated food be consumed only by older persons, whom it will not much affect, with the least contaminated food reserved for children and pregnant women.

The Rand Report concludes that "...long-term radiation problems are a less critical threat to the survival of a population than the central short-term problem, namely, how to protect a substantial fraction of the population from the immediate disaster of a nuclear war."²⁰⁵

205. Kahn, et al.,

R-322-RC Rand Corporation Report on a Study of Non-Military Defense
at 21.

Even if the medical effects of nuclear war might not be insoluble, there remains the problem of economic recovery. Would the survivors be condemned to lives without hope, with standards of living, for most, similar to those of the early years of the industrial revolution?

In the absence of reliable predictions of social response to thermonuclear attack, there is a tendency to lurid speculation. One can too easily visualize society collapsing, with the survivors organizing themselves into robber bands and struggling for the few economic resources remaining, or masses of city dwellers suffering crippling mental breakdown, or mankind rejecting science and technology and reverting to a hunting-and-gathering or at best pastoral existence. Others speculate upon the probability of mass panic or of widespread looting and other criminal behavior.

Just such speculations were made in Britain before the war, and made by sober scientists, government officials and soldiers. The Army Council instructed General Officers Commanding that "the initial preoccupation" of the troops would be "to sustain public morale."²¹⁴ At the time of Munich, when evacuation was being considered, "... discussions were held on the question of drafting regular troops into London to keep order and prevent panic. . . ."²¹⁵ Gloomiest of all were the predictions of the psychiatrists, who thought that mental casualties might outnumber physical casualties by two or three to one:²¹⁶

... the experts foretold a mass outbreak of hysterical neurosis among the civilian population. It was expected that the conditions of life brought about by air raids would place an immediate and overwhelming strain upon the individual. Under this strain, many people would regress to an earlier level of needs and desires. They would behave like frightened and unsatisfied children, and they would demand with the all-or-none vehemence of infants the security, food and warmth which the mother had given in the past.

None of this, of course, occurred. Rather than a dramatic increase in neurosis or mental illness, there was in fact a decrease. Statistics for insanity, suicide, drunkenness and disorderly behavior fell by as much as half.²¹⁷ Workers absented themselves from their factories after heavy bombing only when their houses had been damaged or destroyed, and then only for an average of six days.²¹⁸

214. Titmuss, op. cit. supra note 73 at 19.

215. Id. at 30.

216. Id. at 338-339.

217. Id. at 340-341.

218. Id. at 341.

Individual and group protection against chemical attack poses great problems. In World War I, gas was considered one of the most effective means for producing casualties,¹¹⁷ even though the CW agents used then were far less lethal than the nerve gases developed in Germany prior to World War II. A seven-ton load of nerve gas can reportedly cause casualties over an area fifteen miles wide and twenty-five to fifty miles long, and death over an area of 100 square miles,¹¹⁹ given weather conditions favorable to the spread of gas clouds.¹²⁰ New non-lethal gases are under development, including the so-called psychochemicals, related to compounds used to simulate mental disease, and other incapacitating agents. These agents affect victims by upsetting normal behavior patterns or physiological processes,¹²¹ though their short-term effectiveness appears to suit them more to tactical use against troops than to attack of civilian populations.

117. Rothschild, Brig. Gen. J. "Germs and Gas, the Weapons Nobody Dares Talk About" 218 Harper's Magazine 29 at 30 (June 1959). This article also states, ibid, that 26.8 per cent of AEF casualties were caused by gas. FCDA Technical Bulletin 11-25, "Introduction to Chemical Warfare" (1957) states that mustard gas and other blister gases produced more than 400,000 casualties in the last 16 months of World War I, more than were caused by any other weapon then in use. U.S. House, Committee on Science and Astronautics, Research in CBR, House Report No. 815, 86th Cong., 1st Sess. (1959) states at 4 that some 9 million artillery shells filled with mustard gas produced about 400,000 casualties, which effect was about five times that produced by high explosive shell, on a casualty per ton of shell basis. One should also note that CW casualties in World War I included few deaths. About one-third of U.S. casualties were caused by gas, but only 2 per cent of these died, as compared with 25 percent of nongas casualties. Ibid.
- 119 U.S. Senate, Committee on Armed Services, Hearings, Civil Defense Program, 84th Cong., 1st Sess. (1955) Part 2 at 800. The 100 square mile figure also appears in ACS, id. at 3.
120. "Inversion" conditions, where air temperatures increase with increase in altitude, are most favorable to the spread of gas clouds, and obtain on clear nights and early mornings until about one hour after sunrise. U.S. Department of the Army, Technical Manual 3-240, Field Behavior of Chemical Agents, Washington, 1951, at 16.
121. U.S. House, Committee on Appropriations, Hearings, Department of Defense Appropriations for 1960, 86th Cong., 1st Sess. (1959) Part 6 at 364-365 and 426-436.

In Great Britain, in contrast, some 44 million masks were distributed by the outbreak of World War II, virtually one per inhabitant, and 1.4 million infants' respirators and 2 million children's masks by January, 1940;¹³⁷ 55 million masks are now stockpiled in Britain for issue to civilians.¹³⁸ (They are 1950 designed civilian C7 respirators.)

Procuring 100 million masks for that part of our population concentrated in urban areas might cost \$250 million, at \$2.50 per mask, and extensive training in defense against BW and CW would also be required.

137. O'Brien, Terence, Civil Defence, London, HMSO, 1955 at 330. Note that as early as 1935 the British government decided that masks would have to be issued free of charge. Id. at 61.
138. Interview Col. Francis B. Stewart, FCDA (now OCDM), Battle Creek, Michigan, January 30, 1958.

3000 roentgens per hour intensity at one hour
12,000 roentgens outdoor dose in the first year
10,000 r in the first two weeks (emergency phase)
2000 r in the remaining fifty weeks (reclamation phase)

EMERGENCY PHASE
(10,000 r)

RECLAMATION PHASE
(2000 r)

<u>Shelter attenuation</u>	<u>10,000 r dose reduced to</u>	<u>Decontamination effectiveness (reduction to)</u>	<u>2000 r dose reduced to</u>
1/100	100	90% (1/10)	200
1/1000	10	99% (1/100)	20

Radiological decontamination involves no very mysterious or sophisticated techniques. In general, fallout material can be swept or flushed off

Evacuation

Contrary to popular belief, the effectiveness of tactical evacuation is by no means destroyed by the ICBM. While it is clear that no tactical evacuation could even be started during the 30-minute flight of an ICBM, it is also true, as the Rand Report points out, that cities are not likely to be attacked with the enemy's first ICBM salvo, and it is quite possible that most cities might not be attacked at all.

As Herman Kahn has pointed out, a national evacuation capability could be of the greatest importance in time of international crisis: If the Soviets evacuated their cities, they would have made it highly credible that they were prepared to go to war unless we backed down. 155

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155. Kahn, Herman, On Thermonuclear War, Princeton, N.J., Princeton University Press, 1960 at 213-214, also 132. Objections to evacuation and other nonmilitary defense measures are dealt with at 641-651, with objections bearing on evacuation in particular at 648-651.
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The Bureau of Roads in 1956 prepared a report¹⁶⁰ on national evacuation capabilities for 161 urban target areas, containing 90.7 million people, about 55 per cent of the population. The report assumed orderly and disciplined movement, making maximum use of escape routes, and the findings included the following:¹⁶¹

- (1) In 1 1/2 hours, 32 million persons could be evacuated at least 15 miles from the centers of target areas, over existing highways and streets;
- (2) In 4 1/2 hours, 72 million persons could be evacuated at least 15 miles from target area centers;
- (3) In 2 hours, 22 million persons could be evacuated at least 25 miles;
- (4) In 5 hours, 53 million persons could be evacuated at least 25 miles;
- (5) Evacuation of the largest cities within reasonable time limits would not be possible.

In sum, four hours' warning would allow substantial clearance of all but the largest cities, and even in these cities, this warning would allow evacuation of some 9 million of their 48 million inhabitants. 162

160. Reprinted and discussed in U.S. House, Committee on Government Operations, Hearings, New Civil Defense Legislation, 85th Cong., 1st Sess. (1957) at 111-136.

161. Discussed id. at 124-126.

162. OCDM Operations Research Office, A Preliminary Analysis of Nonmilitary Defense, Battle Creek, Michigan, 1959 at 169.

Since 1956 Great Britain has had a simple scheme for classifying radiation zones by intensity and for evacuating the most dangerous zone, of 1000 r/hr and upwards at $H \neq 1$.¹⁷¹ Such a program is dependent on a monitoring system, so that fallout zones may be delineated and appropriate instructions given their inhabitants. It requires sophisticated and technically competent control, related to the area affected by fallout, not to preattack political subdivisions.

Remedial evacuation also requires detailed arrangements for traffic control, if existing transport within the most dangerous area is relied on for evacuation.

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171. Home Office, Radioactive Fall-out, Provisional Scheme of Public Control, London, HMSO, 1956.
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The requirement for rescue forces would depend upon the number of survivors trapped or incapacitated in areas which could be approached by rescue teams. OCDM estimated that in the 1446-megaton attack assumed for the 1959 JCAE hearings, 11.5 million people would have been fatally injured by blast and heat effects and 6.3 million nonfatally injured. Fallout would have caused a further 10.7 million fatal and 10.9 million nonfatal injuries.¹⁷⁵ Many of the blast casualties would require to be rescued and, together with fallout casualties, to be transported from the danger area. Other casualty estimates, however, show markedly fewer blast injuries, on the order of one-fourth of those estimated in the JCAE hearings.¹⁷⁶

(JCAE hearings used gross Hiroshima casualty data, which applies to people watching the B-29 deliver bomb, i.e. no proper "duck and cover" for elayed blast behind windows.)

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175. 1959 JCAE Hearings, Effects of Nuclear War, at 651.
176. SRI calculations show only 1.6 million blast casualties from a 1500-megaton attack
177. Note that casualty effects are extrapolated from experience at Hiroshima and Nagasaki, which were attacks with air-bursted kiloton weapons. U. S. Atomic Energy Commission, Effects of Nuclear Weapons, Washington, 1957, at 456. Factors which may affect casualty numbers include yield, height of burst, strength of buildings (or shelters,) and the weather at the time of attack. Ibid. It is interesting to note that prewar British estimates of casualties from aerial attack, based on limited experience from World War I, turned out in the event to have been too high by 6 times.

Finally, fallout would limit rescue operations. Fallout from surface bursts far upwind might make operations impossible, if radiation levels were so high that rescue crews could not work without accumulating harmful radiation doses. Even if rescue groups could approach damaged areas from upwind, rescue of severe blast and burn casualties from within six or nine miles of ground zero would not be possible to a significant extent, since the level of contamination even upwind of a surface burst would be so high as to prevent rescue parties from working in these areas for several days at least, by which time most of the seriously injured would have died.¹⁷⁸ It might be possible, however, to organize rescue operations on the first day from upwind into the areas of lighter damage, perhaps fifteen miles from the center of a 20-megaton burst, where numbers of casualties would have resulted due to burns and partial collapse of frame houses.¹⁷⁹ Rotation of rescue teams could allow exposure to higher radiation intensities, and hence earlier rescue operations, but would increase the requirement for rescue forces. If weapons were airbursted, so that little fallout contamination resulted, rescue forces could enter blast areas soon after the detonation.

(NOTE: severe upwind fallout in the blast damaged area was measured after 10 megaton surface burst MIKE in 1952, see weapon test report WT-615 and AFSWP-507. However, this upwind fallout was a fluke due to the 82-ton steel bomb "case shock" which embedded itself deep into the crater, increasing the activity on large fallout flakes around ground zero. Data from weapons with lighter casings in Castle 1954 and Redwing 1956 disproved the MIKE upwind fallout data for practical, deliverable weapons, WT-1317. MIKE upwind fallout data was given in Glasstone ENW 1957 but was replaced with Redwing upwind fallout data in Glasstone 1962, so light upwind fallout permitted rescue.)

178. U.S. Federal Civil Defense Administration, Survival in Public Shelters, 1957, at 5-9.

179. Id. at 7-8.

The Corps of Engineers analysis of requirements for rescue squads is in U.S. Army Engineer School, Extension Subcourse 321, Civil Defense and Disaster Recovery, Ft. Belvoir, Virginia (May 1958) at 3-3 to 3-4. This document states that about 25 per cent of persons surviving in blast-damaged areas will be lightly trapped and 5 per cent heavily trapped. About 2 man-hours are required to release persons lightly trapped and 20 man-hours for those heavily trapped. Trapped casualties can survive for 4 days, and rescue squads can each produce some 768 man-hours of efficient rescue work in this time. Thus in a city where 100,000 persons remained in blast areas, about 25,000 people would be lightly trapped and 5000 heavily trapped. This would require 65 light rescue squads and 130 heavy squads, each composed of 26 men with appropriate equipment. The total rescue force requirement is thus 5070 persons, or about 50 per 1000 of target area population at the time of detonation.

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One promising avenue for reducing vulnerability is to put selected industries underground. The Rand Report suggests that if we had put something like twenty per cent of our manufacturing capital underground by 1970, that economy ought to be able to withstand a 20,000-megaton, 150-city attack somewhat better than our undispersed economy in 1960 could withstand a 1500-megaton, 50-city attack.²⁵² A 1956 study by the Corps of Engineers discussed in some detail the problems of constructing underground industrial plants. The study pointed out that some sixty per cent of American industry lay in a quadrangle from Boston to Kansas City, and that about two-thirds of existing mine sites, suitable for underground plants, also lay in this quadrangle.²⁵³ Experience both with underground plants in Sweden and Germany and with windowless, fully air-conditioned surface plants in this country indicates that no major personnel problems are likely to arise from working underground.²⁵⁴

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- 252. Kahn, Rand Report, op. cit. supra note 62 at 29-30 and 11.
- 253. U. S. Department of the Army, Corps of Engineers, Underground Plants for Industry, Washington, GPO, 1956 at 7; see too id. at 19.
- 254. Id. at 37-38 and 7. For discussion of an underground metal processing and fabricating plant in Norway see Skarsgaard, Olav K., "The Largest Underground Industry in the World." The Fifteen Nations (Number 16) at 124-125.

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CIVIL DEFENSE FOR THE 1980's--CURRENT ISSUES

Presidential Decision (PD) 41, September 1978, established new policies for U.S. civil defense: that it should "enhance deterrence and stability and. . . reduce the possibility that the Soviets could coerce us in times of increased tension," and "include planning for population relocation during times of international crisis." The PD 41 policies are in marked contrast to previous rationales for CD, dating from 1961, which were to the effect that the program should provide "insurance" in the unlikely event of a failure of deterrence.

President Kennedy in 1961:

But this deterrent concept assumes rational calculations by rational men. And the history of this planet, and particularly the history of the 20th century, is sufficient to remind us of the possibilities of an irrational attack, a miscalculation, an accidental war, or a war of escalation in which the stakes by each side gradually increase to the point of maximum danger which cannot be either foreseen or deterred. It is on this basis that civil defense can be readily justifiable--as insurance for the civilian population in case of an enemy miscalculation. It is insurance we trust will never be needed--but insurance which we could never forgive ourselves for foregoing in the event of catastrophe.^{18/}

^{18/}President John F. Kennedy, "Urgent National Needs, A Special Message to Congress," May 25, 1961.

More light was shed on issues of credibility by a national-sample survey conducted for DCPA in late 1978, involving in-depth interviews with 1620 adult Americans.^{31/} The results suggest that the public remains favorable in general to civil defense, and is receptive to crisis relocation in particular:

67% believe there could be crisis circumstances under which the President might urge people to evacuate high risk areas

78% believe the U.S. should have crisis relocation plans

70% say that if the President directed relocation, they would comply. (And additional people indicate they might well leave spontaneously, before any direction to do so)

75% believe the nation's communities would be helpful to evacuees

82% believe their own communities would be helpful, if asked to host evacuees. (In fact, 73% say they'd be willing to take evacuees into their own homes)

^{31/}Nehnevassja, Jiri, Issues of Civil Defense: Vintage 1978--Summary Results of the 1978 National Survey, University of Pittsburgh, 1979.

It is significant that on September 1-3, 1939 the British moved some 1.5 million women and children from London and a few other large cities in what was a crisis evacuation, for Britain did not declare war until September 3. (Also of interest are the facts that some 2 million additional persons spontaneously evacuated at their own initiative, and that this was unsuspected at the time by the British government.) It is also worthy of note that in Hurricane Carla, in 1961, between half and three-quarters of a million people were evacuated from Gulf Coast cities without a single fatality or a major reported accident.^{32/}

32/Senate Committee on Banking, Housing, and Urban Affairs, Hearings, Civil Defense, 95th Congress, 2d Session (January 1979) at 51-52.

In 1939, Hitler attacked Poland, though it appears he calculated (mistakenly) that he had good chances of achieving his objectives without triggering World War II, based upon his earlier successes. In 1941 he attacked the USSR, anticipating the destruction of Bolshevism and not, eventually, of the Third Reich.

In 1941 the leaders of Japan attacked the U.S., not anticipating the defeat of the empire in 1945.

--Presidential Decision 41

At all events, the PD 41 policies lay it down clearly that U.S. civil defense should ". . . enhance deterrence and stability, and contribute to perceptions of the overall U.S./Soviet strategic balance and to crisis stability, and also reduce the possibility that the Soviets could coerce us in times of crisis."

Civil Defense and the Cuban Crisis

In a 1978 interview, Steuart L. Pittman, who was Assistant Secretary of Defense for Civil Defense in 1961 to 1964, pointed out:

[I]t is interesting that President Kennedy personally raised the civil defense question during the Cuban crisis. He was considering conventional military action against Cuba to knock out the missile sites. I understand he was the only one of the "Committee" to raise the issue of civil defense, which tells us something. He asked whether it would be practical to evacuate Miami and other coastal cities in Florida. . . . I was called into the marathon crisis meeting and had to tell him that it would not be practical; we did not have any significant evacuation plans. . . . The President dropped the idea, but shortly after the crisis was over, his personal concern over his limited civil defense options led him to sign a memorandum directing a significant speedup in the U.S. civil defense preparations. (Emphasis added.)^{93/}

While history seldom repeats itself exactly, it does indeed "tell us something" that in the only overt nuclear confrontation the world has

93/Sullivan, Roger J. et al, The Potential Effects of Crisis Relocation on Crisis Stability, System Planning Corporation, Arlington, Virginia, September 1978 at 152-153.

yet seen, the American President was concerned about civil defense--and that the idea of population relocation during the crisis was one of his specific concerns. Certainly it is clear that in 1962, the notion of vulnerability being stabilizing held little attraction for the Chief Executive.

There is an historical precedent for a relatively rapid buildup of CD capabilities. At the time of the 1938 Munich crisis, Britain had developed civil defense plans but had little capability for actual operations. Spurred by the belief that war had become not only not unthinkable but not unlikely, Britain mounted an intensive effort.

By the time Germany attacked Poland the next September, the British were able to evacuate 1.5 million women and children from major target cities. And by the time of the August 1940 "blitz," the CD system was able to contribute substantially to Britain's ability to "take it" and to continue the war.

Following the Munich crisis, which found Britain as unprepared in civil defense as in all other areas of defense, the working of the civil defense services was reviewed by the House of Commons during a censure debate:

Members were in a worried and critical mood, and among the charges made it was maintained that the Government had neither policy nor plans for evacuation when the country was on the verge of war. . . . [T]here was much uneasiness in Whitehall.^{102/}

In short, there will be no public outcry for civil defense in normal times. There will be modest political profit, if any, for an Administration proposing enhanced civil defense, or a Congress approving it; the subject is not a congenial one. But should a frightening crisis find civil defense in disarray, the people (and the Congress) would surely demand to know what had been done in "the years that the locust hath eaten."^{103/}

Summary

The PD 41 policies provide that the U.S. civil defense program should enhance deterrence and stability, and reduce the possibility of Soviet coercion during a crisis.

* * *

^{102/}Titmuss, Richard M., Problems of Social Policy, HMSO, London, 1950 at 30.

^{103/}Joel 2:25. This phrase, according to Churchill, was used by Sir Thomas Inskip in referring to the period 1931-1935: The Gathering Storm, Houghton Mifflin, Boston, 1948 at 66.

Arguments Against Civil Defense and a Rebuttal

Some of the arguments made against civil defense were parodied as follows in a piece in the Harvard Crimson in 1962:

Recommendations by the Committee for a Sane Navigational Policy:

It has been brought to our attention that certain elements among the passengers and crew favor the installation of lifeboats on this ship. These elements have advanced the excuse that such action would save lives in the event of a maritime disaster such as the ship striking an iceberg. Although we share their concern, we remain unalterably opposed to any consideration of their course of action for the following reasons:

1. This program would lull you into a false sense of security.
2. It would cause undue alarm and destroy your desire to continue your voyage in this ship.
3. It demonstrates a lack of faith in our Captain.
4. The apparent security which lifeboats offer will make our navigators reckless.
5. These proposals will distract our attention from more important things, e.g., building unsinkable ships. They may even lead our builders to false economies and the building of ships which are actually unsafe.
6. In the event of being struck by an iceberg (we will never strike first) the lifeboats would certainly sink along with the ship.
7. If they do not sink, you will only be saved for a worse fate, inevitable death on the open sea.
8. If you should be washed ashore on a desert island, you could not adapt to the hostile environment and would surely die of exposure.
9. If you should be rescued by a passing vessel, you would spend a life of remorse mourning your lost loved ones.
10. The panic caused by a collision with an iceberg would destroy all semblance of civilized human behavior. We shudder at the prospect of one man shooting another for the possession of a lifeboat.
11. Such a catastrophe is too horrible to contemplate. Anyone who does contemplate it obviously advocates it.



HISTORY OF THE
SECOND WORLD WAR

*Civil
Defence*

By
T. H. O'BRIEN

The point is of importance for students of the subject in an era in which marked 'progress' has been made in the technique of air warfare by the invention of the atomic bomb. This invention has given fresh currency to the view that 'nowadays every war is different from the one before'—which, if it were valid, would abolish any need to learn the lessons of past experience.

THE WAR OF 1914–1918

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But in May 1917 the Germans began a series of assaults with twin-engined aircraft, called *Gothas*, which soon became severe. The daylight attack of 13th June on London by fourteen *Gothas* was the worst single attack of the war measured in casualties, which numbered 162 killed and 426 injured; 118 high explosive and incendiary bombs were dropped on the City and the East End.

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Ch. I: INTRODUCTION

The Government only gave in gradually and reluctantly to demands for public warnings in London. In July 1917 a system was introduced, under the control of the Commissioner of Police, which to those accustomed to the sirens of 1939–45 may appear somewhat primitive. Warnings were distributed partly by maroons (or sound bombs) fired into the air, and partly by policemen on foot, on bicycles or in cars carrying *Take Cover* placards and blowing whistles or sounding horns.

THE WAR OF 1914–1918

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during 1914–18

There were in all 103 bombing raids (51 by airships and 52 by aeroplanes); and about 300 tons of bombs were dropped causing 4,820 casualties, 1,413 of which were fatal.

These totals appear small; but when they are broken down into details many different pictures emerge. The two heavy raids on London of June and July 1917, for example, together caused 832 casualties (216 fatal), which amounted to 121 casualties for each ton of bombs dropped; and these casualty figures were to have much significance for the planning authorities of the future.

13 June London raid: 118 bombs, 162 killed, 426 injured.

7 July London raid: 54 killed, 190 injured

121 casualties/ton, 31 killed/ton

(Air raids by twin-engined *Gothas* began in May 1917)

The Committee of Imperial Defence, created in 1904

In November 1921 the Committee asked the principal Service experts to report on the problem of possible future air attack on the United Kingdom. This report, which appeared the next year, accepted the conclusions of the Air Staff about future air attack, which were briefly as follows.

France's Air Force could drop an average weight of 1,500 tons of bombs on Britain each month by using only twenty bombing days in the month and only fifty per cent of its aircraft. London, which would be an enemy's chief objective, could be bombed on the scale of about 150 tons in the first 24 hours, 110 tons in the second 24 hours, and 75 tons in each succeeding 24 hours for an indefinite period. It was to be anticipated that an enemy would put forth his maximum strength at the outset.

Page 14: on 15 May 1924, the Air Raid Precautions (ARP) Sub-Committee first met, chaired by Sir John Anderson.

THE SCALE OF ATTACK

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The serious picture thus presented assumed its darkest tones when the Air Staff proceeded to estimate casualties. The 300 tons of bombs dropped in the 1914-18 attacks, the experts pointed out, had caused 4,820 casualties, or 16 per ton of bombs. The 832 casualties of the two big daylight attacks on London in the summer of 1917, however,

16 *Ch. II: PLANNING (MAY 1924-APRIL 1935)*

produced an average of 121 casualties per ton; and sixteen night raids on London in 1917-18 gave an average of 52 casualties per ton.¹ After weighting these figures with various factors, the experts concluded that 50 casualties (one-third of which would be fatal) per ton formed a reasonable estimate of casualties caused by air attacks of the future on densely-populated areas. For other areas this figure should be reduced in proportion to the actual density of population.

30 *Ch. II: PLANNING (MAY 1924-APRIL 1935)*

In March 1927 the committee was faced with two matters

The Chemical Warfare Research Department had been making experiments to determine how long persons could remain under certain conditions in a 'gas-proof' room; and had prepared a handbook, *The Medical Aspects of Chemical Warfare*, now on sale to the public.

The first of the matters just referred to was a broadcast in February by Professor Noel Baker, on 'Foreign Affairs and How They Affect Us'. This, read in cold print at a distance of twenty years, appears as an attempt to rouse the British public to realisation of the horrors of future war, and to enlist its support for the disarmament negotiations at Geneva. The Professor quoted Mr Baldwin's speech to the Classical Association in the Middle Temple hall, 'Who in Europe does not know that one more war in the West and the civilisation of the ages will fall with as great a shock as that of Rome?' He painted a picture of gas attack from the air in another war and claimed, 'all gas experts are agreed that it would be impossible to devise means to protect the civil population from this form of attack'. The Chemical Warfare Research Department emphatically disputed the accuracy both of the details of the picture and of this general statement. They considered it unfortunate that statements of this nature should have been broadcast to the public, particularly after the Cabinet's decision that the time was not ripe for education of the public in defensive measures.

The committee discussed whether to draw the B.B.C.'s attention to this talk. The Corporation, only a few months old, was then prohibited by the Postmaster-General's instructions from broadcasting 'matter on topics of political, religious or industrial controversy'; but the Post Office representative pointed out this did not mean that his Department was prepared to undertake censoring programmes. The committee, not wishing to incur the obligation to approve in advance all proposed broadcasts relating to their field of study, decided to take no action with respect to the talk in question.

68 Ch. III: THE A.R.P. DEPARTMENT (1935-1937)

Gas was the risk most prominently associated in the public mind with future air attack, as was demonstrated a few weeks before the school opened by British reaction to Italy's use of mustard and other gases against Abyssinia.⁴

⁴ According to the *Annual Register*, 1936 (p. 27), 'feeling in England could hardly contain itself when the Italians were reported to be using poison gas against both soldiers and civilians'.

A final matter which concerned gas-masks belongs perhaps more properly to the topic of public reactions to A.R.P. Early in 1937 some scientific workers at Cambridge University, who described themselves as the 'Cambridge Scientists' Anti-War Group' and their function as that of acting as 'a technical and advisory body to national and international peace movements', published a book attacking the Government's A.R.P. plans.¹ This body had studied the official advice about the 'gas-proofing' of rooms, the civilian mask, and extinguishing incendiary bombs, and then conducted some experiments. It claimed to have shown that the measures officially proposed were ineffective or inadequate, and implied that these constituted deception of the public.

It has been noticed that as 1937 opened the Government was taking steps to make A.R.P. plans more widely known to the public;² and this deliberate challenge found a sympathetic echo in various quarters, and caused it some concern. Questions about the Cambridge experiments were asked in Parliament, for example on the occasion of the announcement of the new Wardens' Service; sections of the Press began a critical campaign, and questions were put to officials trying to build up A.R.P. services over the country. The Government's reply was that the experiments were academic (in the sense of removed from reality), and based on fallacious assumptions about the conditions likely to be met in actual warfare.³ In spite of pressure the authorities refused to engage in technical controversy with the scientists in question and within a few months the agitation subsided. At the close of the year, however, a report on the official experiments (in supervision of which the Chemical Defence Committee had been helped by eminent scientists not in Government employment) was circulated to local authorities and otherwise made public.

¹ *The Protection of the Public from Aerial Attack* (Left Book Club Topical Book, Victor Gollancz Ltd, 1937.)

² p. 71.

³ H. of C. Deb., Vol. 320, Col. 1348, 18th February 1937.

86 Ch. III: THE A.R.P. DEPARTMENT (1935-1937)

A demonstration of how to deal with the light incendiary bomb had been included in the Anti-Gas School curriculum in November 1936; and in February 1937 the Home Office Fire Adviser staged a demonstration at Barnes at which bombs were successfully controlled and fires extinguished by teams of girls with only short training. At an exercise held later at Southampton a group of air raid wardens carried out this function with such success that the Department concluded it must aim to train all householders in the handling of incendiary bombs.

Air Staff had raised their estimate of the weight of bombs which an enemy (now Germany) might drop on Britain during the first stages of an attack from 150 tons *per diem* to no less than 600 tons. The committee proceeded, as their predecessor of 1924 had done, to question the experts and then to accept their hypothesis.¹ The estimate of over 600 tons of bombs *per diem* during the first few weeks (which took account of Britain's various potential forms of counter-offensive) also embraced the possibility of a special bombing effort on the part of the enemy in the first 24 hours which might amount to 3,500 tons. Consideration had to be taken not only of this greatly increased weight of attack but of new methods of attack for which past experience afforded no precedents. The measure offered by the accepted air raid casualty figure of 1914-18 (50 per ton of bombs, 17 of which were killed and 33 wounded) was subject to the *caveat* that modern bombs were more effective. The committee pointed out that an arithmetical computation on this basis for the scale of attack at 600 tons *per diem* would indicate casualties of the order of 200,000 a week, of which 66,000 would be killed.

¹ The new estimated scale of attack had been referred to the Home Defence Committee, and was not approved by the Committee of Imperial Defence until 28th October 1937.

ANTI-GAS EQUIPMENT, & OTHER SUPPLIES 139

The 25 million civilian gas-masks accumulated by the opening of 1938 were, from various points of view, one of the most tangible assets of the A.R.P. Service.

SHELTERS; CIVIL DEFENCE ACT, 1939 187

The invention of a practical household shelter—to be quickly known as the 'Anderson'—had transformed the possibilities hitherto envisaged for protection of homes against air attack. The Government had undertaken to supply these shelters, as well as steel fittings for strengthening basements, free to some 2½ million families.

The 'Anderson' had originally been conceived as a shelter to be erected inside the average small working-class home. But the experts soon discarded this idea as open to various objections, including the probability that occupants would be trapped by the fall of their house and killed by fire or escaping coal-gas. During Munich householders had been advised to dig trenches in their yards or gardens, and now, by an extension of this plan, the 'Anderson' was designed as an outdoor or surface shelter. It consisted of fourteen corrugated steel sheets weighing, with other components, about 8 cwt. A corrugated steel hood, curved for greater strength, would be sunk some two feet in the ground and covered with earth or sandbags.

The programme for manufacture and distribution by the end of 1939-40 of 2½ million 'Andersons' to protect about 10 million citizens was being steadily carried through.

SHELTERS

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householders in May in the form of a booklet, *Your Home as an Air Raid Shelter*.¹ This stated that an ordinary soundly-built house would offer very substantial protection; and it gave those unable to build some form of shelter much detailed guidance on the preparation of refuge rooms, the protection of windows and so on.

¹ H.S.C. 98/40, 22nd May 1940.

416 *Ch. X: THE TIDES OF BATTLE***16 April 1941: heaviest London air raid of WWII:**

On the night of 16th-17th some 450 aircraft made the heaviest raid so far on the capital, dropping 446 tons of high explosive and 150 tons of incendiaries and causing more casualties—about 1,180 killed and 2,230 badly injured—than in any previous attack.¹ Over 2,250 fires were started; and the centre and south of the metropolis bore the brunt of the attack.

¹ German records show the much higher figures of 685 aircraft, 890 tons of H.E. and 4,200 incendiary canisters dropped. This attack proved the worst on London of the war in terms of weight of bombs dropped, casualties inflicted and the number of fires caused.

438 *Ch. X: THE TIDES OF BATTLE 1943:*

These occasions apart, the attack was predominantly of the tip and run or—as it was sometimes called—'the scalded cat' variety. The worst single incident of the year took place on 3rd March at Bethnal Green Tube shelter when, ironically enough, no attack was in progress on this particular area. A night attack of moderate proportions was being made on London, and warnings had sounded. A woman among the crowd entering this shelter, encumbered by a baby and a bundle, fell, causing those pressing behind her to tumble in a heap and the death by suffocation of no less than 178 persons. **3 March 1943**

508 *Ch. XII: SHELTERS*

In London a periodical count was made of shelterers, usually once a month; but this took place on a single night which was not necessarily typical. In addition, the population was continually fluctuating owing to evacuation, the call-up to the Forces and war damage. The first shelter census in Metropolitan London, taken early in November 1940, showed that 9 per cent. of the estimated population spent the night in public shelters, 4 per cent. in the Tubes and 27 per cent. in household shelters—in all, only 40 per cent. in any kinds of official shelter. In September and October this proportion was probably a good deal higher. Later, as the London public became accustomed to raids, the figures dropped.

Experience of raids also led to the introduction of an entirely new type of household shelter. 'Andersons', though structurally satisfactory, had not originally been intended for sleeping and became in many cases unfit for winter occupation. Domestic surface shelters were very cramped when used for sleeping and were in some places not popular, and strengthened domestic basements had been neither very successful nor widely used. After night raiding had ceased to be a novelty, many people preferred to stay in their houses rather than to go out of doors even to their own domestic shelters. The 'Anderson', it will be recalled, had at first been envisaged as an indoor shelter. Since many people were now determined to remain in their homes, it had become necessary to introduce some indoor shelter which might reduce the risk of injury from falling masonry and furniture. The fact that many who had hitherto sheltered under their staircases or furniture had been rescued unhurt from the wreckage of houses suggested that extra protection might be given by a light structure on the ground floor.

By the end of 1940 two designs had been produced. The first, later known as the 'Morrison' shelter, had a rectangular steel framework 6 ft. 6 in. long, 4 ft. wide and about 2 ft. 9 in. high. The sides were filled in with wire mesh, the bottom consisted of a steel mattress and the top was made of steel plate an eighth of an inch thick, fastened to the framework by bolts strong enough to withstand a heavy swinging blow. The shelter, which could be used as a table in the daytime, could accommodate two adults and either two young children or one older child, lying down. Experiments showed that it would carry the debris produced by the collapse of two higher floors.

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Ch. XII: SHELTERS

The Prime Minister showed great interest in these shelters the first of which, in fact, were erected in No. 10 Downing Street.² In January 1941 the Cabinet approved the manufacture of 400,000, providing protection for perhaps 1,200,000 people.³

In February contracts had been placed for 270,000 shelters, and another order for the same number was placed in April (thus exceeding the 400,000 originally approved). Two further orders for 270,000 were placed at the end of July and the end of September.

¹ Instructions were given in a pamphlet, *How to put up your Morrison shelter*, on sale to the public.

² One with a flat top and one with a curved top were erected in No. 10 Downing Street. The Prime Minister was at first inclined to favour the curved design but he afterwards recognised the advantages of the flat top, which would allow the shelter to be used as a table, and gave his approval to both designs.

³ It was estimated that each 'Morrison' would use over 3 cwt. of steel, and that about 65,000 tons would be needed for the 400,000 shelters. This proved to be an underestimate since the table shelter, as finally designed, actually weighed 4.43 cwt.

In June a revised version of *Your Home as an Air Raid Shelter* was issued with the title *Shelter at Home*. This included information about three types of shelter which could be put inside refuge rooms—the 'Morrison', a commercially made steel shelter, and a timber-framed structure designed by the Ministry of Home Security.

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Ch. XII: SHELTERS

It was assumed that to be effective in attacks by pilotless aircraft or long-range rockets, shelters would have to be easily accessible. Yet a review of London shelter in the summer of 1943 had shown that large numbers still had no domestic shelter, and that many thousands would be unable to reach a public shelter quickly. Though the obvious solution to the problem was the 'Morrison', production of these had stopped twelve months before; and in order to build up a reserve issue had been discontinued in various areas, including London. At the beginning of October it was decided that another 100,000 'Morrison's' should be manufactured and that the reserves held in Scotland, the North of England, the Midlands and North Wales should be moved to the vicinity of London and to the Reading and Tunbridge Wells Regions, from where they could, if necessary, be used to supply London.

Large-scale redistribution of 'Morrison's' and the procurement of new ones called for a substantial administrative effort. Nonetheless, most reserves were transferred during the autumn, and by the end of January 1944 some 12,000 had been distributed to London householders. At the beginning of this year, however, preparations for the Allied invasion of Europe began to choke the railways with more important traffic, and it became impossible to transport new shelters from manufacturers in the north of England. This difficulty, combined with delays in the production of spanners and nuts, meant that no new shelters could be delivered before late February or early March, when it was expected that the V-weapon attacks would have begun. Arrangements were made for some to be shipped coastwise to London; but in mid-February the contract for the remaining 'Morrison's' (about 20,000) was cancelled. **V2 THREAT:**

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Ch. XV: CHALLENGE OF 'V' WEAPONS

On 11th September the War Cabinet considered the need for a revival of the plan (known as the 'black move') to evacuate a proportion of the staffs of Government Departments from London. The numbers now involved in such an exodus of the war-expanded Departments would be high, and difficulties of communications, transport, accommodation and billeting again seemed overwhelming; it was, therefore, agreed that the more practical course would be to devise measures such as 'citadel' accommodation to enable essential work to continue in London. The production of the further 100,000 'Morrison' shelters and the work on the reinforcement of street shelters proposed by the Home Secretary were also authorised.

As far as shelter policy was concerned, orders had been placed in September 1943 for an additional 100,000 indoor table shelters and existing stocks were moved into the areas of probable attack. Difficulties of manufacture and transport had led to poor deliveries of 'Morrisons', and it seemed unlikely that more than half of the additional shelters ordered would be available by the time attacks were likely to begin. As the remainder would probably arrive too late to be of any use, contracts for the shelters were to be reduced by about 25,000. On the question of deep Tube shelters it had been agreed earlier that priority in the allocation of space would have to be given to the essential machinery of government. The Ministry of Works worked out a plan to shelter those government staffs not already provided for in the strengthened basements of their own steel-framed buildings. All shelter plans, the reader will recall, were given valuable impetus by the resurgence of 'conventional' attack on London and the south in the 'Little Blitz' of early 1944.

V1 flying bomb: *THE 'V.1' ATTACKS*

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Flying glass was a special danger and people were warned to take cover on the sound of a bomb diving or the engine stopping, and later on the sounding of imminent danger warnings. The vast damage to houses inevitably caused great domestic upheavals. To begin with there was a definite decline in production in London, due to an increase in the rate of absenteeism, to loss of time in actual working hours through workers taking shelter and to lowered efficiency through loss of sleep and anxiety. The extension of the industrial alarm system and the increase in the labour force repairing damaged property, however, soon reduced these early signs of disturbance. Within a few weeks evacuees were returning to London, shelters were less full and most people were going about their normal tasks as usual.

For the civil defence services the new weapon demanded new tactics. In many ways these attacks were much easier to contend with than ordinary bombing. Firstly, most of the incidents were isolated, so that services could be directed in strength to the affected area without constant competing demands on the personnel at every turn. Secondly, the fall of the bombs could be spotted within a matter of seconds by high-placed observation posts either by night or by day, so that rescue and first aid squads could be on the spot very quickly. Thirdly, the penetrative power of this weapon was slight so that incidents rarely involved the complications of broken gas, electricity or water mains, and there was also little tendency for fires to break out. On the other hand the bombs could fall at any time in crowded thoroughfares; the proportion of casualties in the streets was much higher than ever before while the proportion of trapped casualties was lower. At night time, since there were no German eyes above, the use of artificial light was less restricted and searchlights could be used for rescue work.

APPENDIX IV

Major night attacks on United Kingdom cities and towns from 7th September, 1940 to 16th May, 1941

<i>Target Area</i>	<i>Number of Major Attacks¹</i>	<i>Tonages of H.E. Aimed</i>
London . . .	71	18,291
Liverpool-Birkenhead . . .	8	1,957
Birmingham . . .	8	1,852
Glasgow-Clydeside . . .	5	1,329
Plymouth-Devonport . . .	8	1,228
Bristol-Avonmouth . . .	6	919
Coventry . . .	2	818
Portsmouth . . .	3	687
Southampton . . .	4	647
Hull . . .	3	593
Manchester . . .	3	578
Belfast . . .	2	440
Sheffield . . .	1	355
Newcastle-Tyneside . . .	1	152
Nottingham . . .	1	137
Cardiff . . .	1	115

¹ The enemy's definition of a 'major attack', i.e. one in which 100 tons or more of high-explosive bombs were successfully aimed at the target, has been adopted for this table.

*Issued for the Ministry of Home Security
by the Ministry of Information*

FRONT LINE

1940 - 41

The Official Story of the
CIVIL DEFENCE
of Britain

1942

London : His Majesty's Stationery Office

The outcome may be seen in the following table, which shows coastal bombing to November, 1941, in round figures.

<i>Town.</i>		<i>Number of Raids.</i>	<i>Civilians Killed.</i>	<i>Houses Damaged.</i>
Fraserburgh	...	18	40	700
Peterhead	...	16	36	700
Aberdeen	...	24	68	2,000
Scarborough	...	17	30	2,250
Bridlington	...	30	24	3,000
Grimsby ...	...	22	18	1,700
Gt. Yarmouth	...	72	110	11,500
Lowestoft	...	54	94	9,000
Clacton ...	...	31	10	4,400
Margate	...	47	19	8,000
Ramsgate	...	41	71	8,500
Deal ...	...	17	12	2,000
Dover ...	...	53	92	9,000
		(and shelling)		
Folkestone	...	42	52	7,000
Hastings ...	...	40	46	6,250
Bexhill ...	...	37	74	2,600
Eastbourne	...	49	36	3,700
Brighton Hove ...	}	25	127	4,500
Worthing	...	29	20	3,000
Bournemouth	...	33	77	4,000
Weymouth	...	42	48	3,600
Falmouth	...	33	31	1,100

So far was all this from panic that it took three months for the population of the twenty-eight central boroughs to drop by about 25 per cent. from a little over 3,000,000 (the figure before heavy bombing began) to 2,280,000 at the end of November. In a group of the most heavily bombed eastern boroughs the pre-war population of 800,000 had fallen to 582,000 before the blitz began ; for four months it had dropped steadily to 444,000 ; by 31st December a fall of 23 per cent. These figures do not spell panic, and a further substantial fall in 1941, after continuous heavy raiding had ceased, completes the evidence that those who went did so in cold blood, for practical reasons as valid for their hard-pressed city as for their private selves.

But what did all this mean to the average Londoner ? In November, inner London (the county) contained some 3,200,000 people. Not more than 300,000 of these were in public shelter of any kind, half of that number at most in those larger shelters on which the limelight shone so exclusively. Nor is this all ; in domestic shelter (Andersons, small brick shelters and private reinforced basements) there were no more than

1,150,000 people. Thus of every hundred Londoners living in the central urban areas, nine were in public shelter (of whom possibly four were in "big" shelters), 27 in private shelter, and 64 in their own beds—possibly moved to the ground floor—or else on duty. Particular big shelters, and for a few nights the tubes, were overcrowded, but there was public shelter for twice the number who made use of it. In outer London, with a population of some 4,600,000, there were in November 4 per cent. in public shelter, 26 per cent. in domestic shelter, and 70 per cent. at home or on duty.

In the last great war there had been outbursts of hate against the distant enemy, and shops with German names had been wrecked. This time the citizens did not stop for such things. After the first shock of realisation they found no more need for direct recrimination than does the soldier. Like him, they got on with the job and waited their chance. Neither in this nor in any other way was there a sign of instability ; no panic running for shelter, no white faces in the streets (though plenty of taut, grim ones), no nerve disease. In all London, the month of October saw but twenty-three neurotics admitted to hospital. The mind-doctors had rather fewer patients than usual.



BLOCKED ROADS. The morning of 12th May: each raid sets the police still another traffic problem.



ENORMOUS CRATERS. At the Bank, where the road collapsed into the subway beneath. A temporary bridge was thrown right across it.

CITY OF COVENTRY

PREVENTION OF TYPHOID FEVER

In view of present damage to DRAINAGE communications in the City, special precautions against Typhoid Fever are advised:

BOIL ALL DRINKING WATER



A PENGUIN SPECIAL

THE PSYCHOLOGY OF FEAR AND COURAGE

BY
EDWARD GLOVER

(Published for Blitz air raids in 1940)



PENGUIN BOOKS

HARMONDSWORTH MIDDLESEX ENGLAND

41 EAST 28TH STREET NEW YORK U.S.A.

ON BEING AFRAID

Real knowledge, for example, is one of the best antidotes to unreal fear. *Useful action* is also an excellent preventive, and *vigorous preparation to meet real danger* will enormously reduce unreal fear. The strength of a common purpose will do the rest. Knowledge, a common purpose, and preparedness for action. These are the remedies for faintness of heart in the face of danger.

22

Now as to preparation. You may recall that when Napoleon was asked how he was always able to give an instant decision in a crisis, he replied: "Because I constantly prepare every detail in advance." Here is a discipline you can readily cultivate. Always make a point of knowing beforehand *exactly* what you are going to do in an air raid; whether you find yourself in house, street, train, bus or shelter. Have it word perfect.

23

A
stray crowd packed into a cinema is likely to panic at the cry of "Fire." There are no common bonds between the people concerned; and there are no leaders. Each one is for himself.

34

Already we have the advantage that we are fighting not only for our lives and homes but for the immemorial cause of human liberty. But that is not enough. Provided we are united with our leaders in a common effort, real danger will never sap our morale. The greatest danger to our morale is unreal fear.

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A. R. P.

(Air Raid Precautions)

by

J. B. S. HALDANE, F.R.S.

(Co-inventor of 1915 gas masks)

SEPTEMBER
1938

LONDON

VICTOR GOLLANCZ LTD

1938

keyholes and cracks in the wall or between the floor-boards are to be filled with putty or sodden newspaper.

The windows must be specially protected against breakage by blast or splinters.

(Plastic sheets and duct tape for broken windows)

How far are these precautions effective? In 1937 a committee of the Cambridge Scientists' Anti-War Group published a book¹ in which it was stated that no ordinary room is anywhere near gas-proof.

¹ *The Protection of the Public from Aerial Attack.*

Error of Cambridge Scientists' Anti War Group:

The real criticism is as follows. It is unlikely that there would be a lethal concentration of gas out of doors for a long period. The wind carries gas away, and in cities there are vertical air currents even in calm weather. If many tons of bombs could be dropped in the same small area either at once or in succession this would not be so. But given any sort of defence bombs will be dropped more or less at random.

Suppose we had out of doors during 10 minutes a phosgene concentration of one part in 10,000, which would be fatal in a few breaths to people in the street, the concentration inside would never rise as high as $\frac{1}{15}$ of this value¹ if the leakage time were $2\frac{1}{2}$ hours, which is rather low. (Hence protection factor = 15)

¹ Since 10 minutes is $\frac{1}{15}$ of $2\frac{1}{2}$ hours.

Many of the questions which are asked concerning Air Raid Precautions are unanswerable in the form in which they are put. If I am asked "Does any gas mask give complete protection against phosgene" the only literally true answer is "No." One could not live in a room full of pure phosgene in any of them. And one would be killed if a hundred-pound phosgene bomb burst in the room, even when wearing the very best mask. But one would be safe in a phosgene concentration of one part per thousand, of which a single breath would probably kill an unprotected man. Hence in practice such a mask is a very nearly complete protection.

1. NON-PERSISTENT GASES, such as phosgene. They can be dropped in bombs which burst, and suddenly let loose a cloud of gas, which is poisonous when breathed, but which gradually disperses. If there is a wind the dispersal is very quick; in calm, and especially in foggy weather, it is much slower. These gases can penetrate into houses, but very slowly. So even in a badly-constructed house one is enormously safer than in the open air. Even the cheapest type of gas mask, provided it fits properly and is put on at once, gives good protection against them (see Chapter IV).

2. PERSISTENT GASES, such as mustard gas. Mustard gas is the vapour of an oily liquid, which I shall call mustard liquid. So far as I know this has not been dropped from aeroplanes in bombs on any great scale. It was used very effectively by the Italians in Abyssinia, who sprayed it in a sort of rain from special sprayers attached to the wings of low-flying aeroplanes.

If the mustard liquid could be sprayed evenly, things would be far more serious. All the outside air of a large town would be poisonous for several days. But this would only be possible if the spraying aeroplanes could fly to and fro over the town in formation, and at a height of not more than 300 feet or so. A fine rain of mustard liquid would probably evaporate on its way to the ground, or blow away, if it were let loose several thousand feet up in the air. Spraying from low-flying aeroplanes was possible in Abyssinia because the Abyssinians had no anti-aircraft guns and no defensive aeroplanes. It would probably not be possible in Britain.

THE HAMBURG DISASTER. Fantastic nonsense has been talked about the possible effects of gas bombs on a town. For example, Lord Halsbury said that a single gas bomb dropped in Piccadilly Circus would kill everyone between the Thames and Regent's Park. Fortunately, although no gas bombs have been dropped in towns in war-time, there are recorded facts¹ which give us an idea of what their effect would be. On Sunday, May 20th, 1928, at about 4.15 p.m., a tank containing 11 tons of phosgene burst in the dock area of Hamburg.

Casualties occurred up to six miles away. In all 300 people were made ill enough to be taken to hospital, and of these ten died. About fifty of the rest were seriously ill. These casualties are remarkably small.

¹ Hegler, *Deutsche Medizinische Wochenschrift*, 1928, p. 1551.

WHY GAS WAS NOT USED IN SPAIN

In view of the terrible stories as to the effects of gas, many people are surprised that it has not been used in Spain. First, why was it not used against the loyalist army? Secondly, why was it not used against towns? The soldiers had respirators after about February 1937, but were not well trained in their use, and often lost them. Very few civilians had any respirators at all.

Gas was not used in the field for several reasons. The main reason is that the number of men and guns per mile was far less than on the fronts in the Great War. Gas is effective if you have a great deal of it,

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but the amount needed is enormous. Thus during the night of March 10-11th, 1918, the Germans fired about 150,000 mustard-gas shells into an area of some twenty square miles south-west of Cambrai. If most of the air in a large area is poisoned the effects are serious. But if a few gas shells are fired or a few cylinders let off, the gas soon scatters and ceases to be poisonous, and a man can often run to a gas-free place, even without a mask, before he is poisoned.

Gas was not used against the towns for this reason, and for another, which is very important. Gas only leaks quite slowly into houses, particularly if there are no fires to make a draught, and draw in outside air; and there is very little fuel in loyal Spain.

PANIC

Panic can be a direct cause of death. If too many people crowd into a shelter, especially one with narrow stairs leading to it, they may easily be crushed to death. In January 1918 fourteen people were killed in this way at Bishopsgate Station in London, and sixty-six were killed in a panic in one of the Paris Underground stations as the result of a false gas alarm.

(Bishopsgate Station incident: 28 January 1918)

BACTERIA AND OTHER MICROBES

It is possible that these will be used in some kind of spray or dust. The difficulty is a technical one. It is easy to disperse many solids as smoke. But this needs heat, and cooked bacteria are harmless. Many

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bacteria are killed even by drying. And once bacteria are on the ground they generally stay there. Possibly pneumonic plague or some other air-borne disease might be started by a dust-bomb. Cholera bacilli might be dropped in a reservoir. But they would probably be stopped by filters, and even without this would be likely to die before they reached the houses.

A million fleas weigh very little, and could easily be dropped. In theory they could be infected with plague. In practice this would need a staff of hundreds of trained bacteriologists, and huge laboratories. So with other possible means of infection. Some may very well be tried, if only to create a panic, but I would sooner face bacteria than bombs.

Certain pacifist writers are severely to blame for our present terror of air raids. They have given quite exaggerated accounts of what is likely to happen.

So long as civilian populations are unprotected, criminal States will continue to murder the citizens of their weaker neighbours and to blackmail the stronger.

POISONOUS GASES AND SMOKES 261

PHYSICAL PROPERTIES OF A GAS-CLOUD. Every student of chemistry learns that a heavy gas such as chlorine can be poured from one vessel into another almost like water, whilst a light gas such as hydrogen rapidly rises. Now all the poisonous gases and vapours used in war are heavier than air, so it is thought that they would inevitably flood cellars and underground shelters, and that on the first floor of a house one would not be safe.

But within a short time it would be mixed with many times its volume of air. Now air containing one part in 10,000 of phosgene is extremely poisonous. But its density exceeds that of air by only one part in 4,000.

GAS-MASKS, AND GAS-PROOF BAGS FOR BABIES

THE EARLIEST GAS-MASKS made in 1915, relied on chemical means to stop chlorine, which was the first gas used. A cloth soaked with sodium phenate or various other compounds will stop chlorine on its way through. But it would not stop carbon monoxide, mustard gas, or many other gases. The terrible prospect arose that it would be necessary to devise a new chemical to stop each new gas. There would be a continual series of surprise attacks with different gases, each successful until a remedy was found, and each involving the death of thousands of men.

It is a most fortunate fact that the majority of vapours can be removed from air, not by chemical combination, but by a process called adsorption, which is non-specific. For example lime will stop an acid gas such as carbon dioxide, and woollen cloth soaked in acid will stop an alkaline gas such as ammonia. No single chemical will combine with both.

But charcoal, silica, and various other substances, when properly prepared, will take up vapours of different chemical types. The molecules form a very thin liquid layer on the surface of the adsorbent, as indeed they do on glass or metals. But charcoal is full of pores and has an enormous surface per unit of weight; so it can take up a great deal of gas.

The main characteristic in a vapour which renders it adsorbable is that it should be the vapour of a liquid with a high boiling point. Thus carbon monoxide boils at -190° C, and is hardly adsorbed at all. Phosgene boils at 8° C and is fairly easily adsorbed. Mustard gas boils at 217° C and is very easily adsorbed indeed. This has a lucky consequence. It is quite sure that there are no unknown poisonous gases with a boiling point as low as that of carbon monoxide. For only a substance with very small molecules can have so low a boiling point. And chemists have made all the possible types of very small molecules. It is unlikely that there are any unknown poisonous gases with as low a boiling point as phosgene, though it is just possible. But if there are they will probably be stopped by charcoal. There may very possibly be some vapours of high boiling point more poisonous than mustard gas. But if so I am prepared to bet a thousand to one that charcoal will stop them all.

AD 408 094

FINAL REPORT

11 March 1963

**Recovery and Decontamination
Measures after
Biological and Chemical Attack**

This report has been reviewed in the Office of Civil Defense and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Office of Civil Defense.

Contract OCD-OS-62-183

**Prepared for
Office of Civil Defense
Department of Defense**

by

**Science Communication, Inc.
1079 Wisconsin Avenue, N.W.
Washington 7, D. C.**

To plan for countermeasures against any weapons one must understand the problem—the nature, the potentials, and the limitations. This research project and the resultant final report were intended to bring together current information most applicable to civil defense. It was particularly intended for those who are responsible for planning preparatory, reclamation and countermeasures effort to minimize the damage from a BW/CW attack.

William J. Lacy
Project Coordinator
Postattack Research

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Decontaminants

An important class of decontaminants comprises the common substances or natural influences such as time, air, earth, water, and fire.

Natural Effects

Biological agents are living organisms and tend to die off with time unless they are in a favorable environment with moisture, food, warmth, and other factors necessary for their survival. In addition, most biological organisms are very sensitive to the conditions of temperature and humidity -- and, particularly to the ultra-violet portion of sunlight. Adverse exposure to the elements -- air, sunlight, high temperature, low humidity -- is effective, in fact, against all biological agents except the spore forms of bacterial organisms.

It is generally assumed that in the vegetative form bacteria (as contrasted to the spore form) can persist for less than two hours during daytime and about eighteen hours at night. Since these short-lived bacteria are the most probable agents, outdoor decontamination is usually not called for unless the agent has been identified, either by laboratory tests or by the character of the disease, as one which forms spores or is otherwise known to be persistent.

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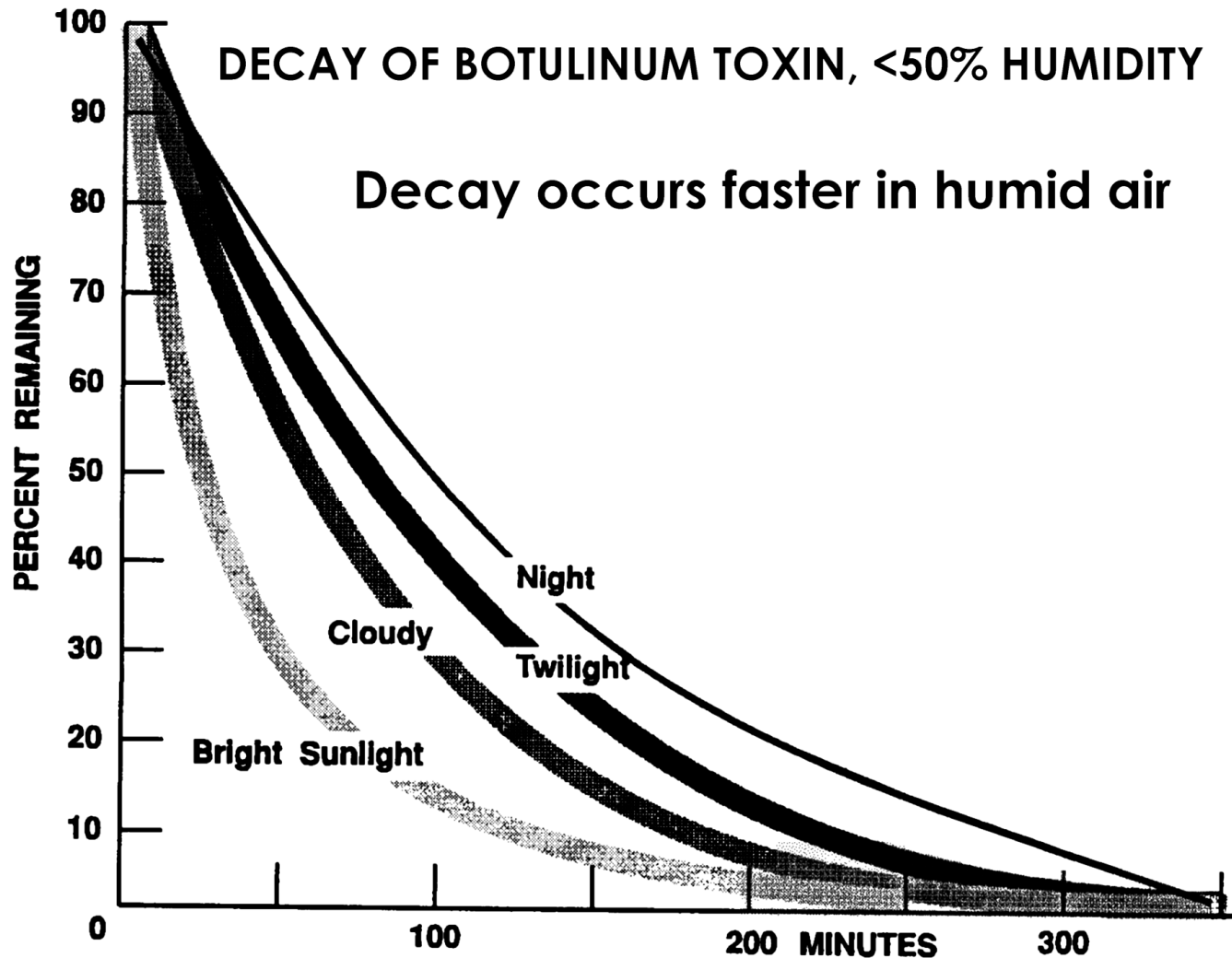
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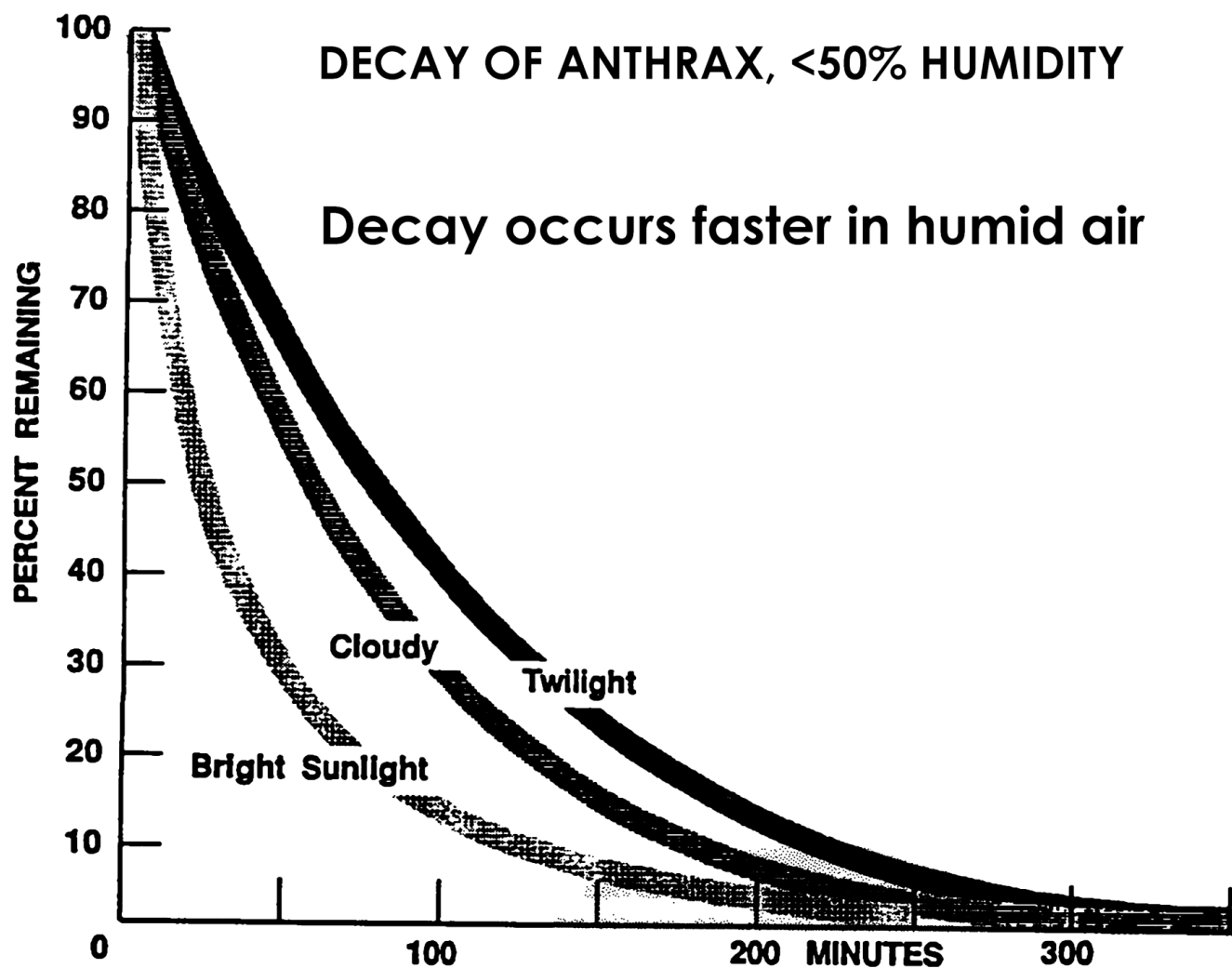
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U.S. Army Field Manual FM 3-3 (1992), Fig. B-3.



U.S. Army Field Manual FM 3-3 (1992), Fig. B-1.

Chemical and biological contamination avoidance, FM 3-3 (1992)

10 grams/square meter

*TABLE 1-2. Chemical Agent Persistency in Hours on
CARC Painted Surfaces.*

Temperature		GA/ GF ¹	GB ^{2,3}	GD ^{2,3}	HD ¹	VX ^{2,3}
C°	F°					
-30	-22	•	110.34	436.69	••	•••
-20	-4	•	45.26	145.63	••	•••
-10	14	•	20.09	54.11	••	•••
0	32	•	9.44	22.07	••	•••
10	50	1.42	4.70	9.78	12	1776
20	68	0.71	2.45	4.64	6.33	634
30	86	0.33	1.35	2.36	2.8	241
40	104	0.25	0.76	1.25	2	102
50	122	0.25	0.44	0.70	1	44
55	131	0.25	0.34	0.51	1	25

NOTE

- 1 For grassy terrain multiply the number in the chart by 0.4.
 - 2 For grassy terrain multiply the number in the chart by 1.75.
 - 3 For sandy terrain multiply the number in the chart by 4.5.
- Agent persistency time is less than 1 hour.
 - Agent is in a frozen state and will not evaporate or decay.
 - Agent persistency time exceeds 2,000 hours.

COMPARATIVE VOLATILITY OF CHEMICAL WARFARE AGENTS

Agent	Volatility (mg/m ³) at 25°C
Hydrogen cyanide (HCN)	1,000,000
Sarin (GB)	22,000
Soman (GD)	3,900
Sulfur mustard	900
Tabun (GA)	610
Cyclosarin (GF)	580
VX	10
VR ("Russian VX")	9

Data source: US Departments of the Army, Navy, and Air Force. *Potential Military Chemical/Biological Agents and Compounds*. Washington, DC: Headquarters, DA, DN, DAF; December 12, 1990. Field Manual 3-9. Naval Facility Command P-467. Air Force Regulation 355-7.

SIGNS AND SYMPTOMS REPORTED BY TOKYO HOSPITAL WORKERS TREATING VICTIMS OF SARIN SUBWAY ATTACKS*

Symptom	Number/percentage of the 15 physicians who treated patients at UH	Number/percentage of 472 care providers reporting symptoms at SLI
Dim vision	11 73%	66 14%
Rhinorrhea	8 53%	No information
Dyspnea (chest tightness)	4 27%	25 5.3%
Cough	2 13%	No information
Headache	No information	52 11%
Throat pain	No information	39 8.3%
Nausea	No information	14 3.0%
Dizziness	No information	12 2.5%
Nose pain	No information	6 1.9%

*Data reflect reported survey of self-reported symptomatology of physicians at the University Hospital of Metropolitan Japan emergency department and all hospital workers at Saint Luke’s International Hospital exposed to sarin vapors from victims of the Tokyo subway attack.
SLI: Saint Luke’s International Hospital
UH: University Hospital
Data sources: (1) Nozaki H, Hori S, Shinozawa Y, et al. Secondary exposure of medical staff to sarin vapor in the emergency room. *Intensive Care Med.* 1995;21:1032-1035. (2) Okumura T, Suzuki K, Fukuda A, et al. The Tokyo subway sarin attack: disaster management, Part 1: community emergency response. *Acad Emerg Med.* 1998;5:613-617. (3) Okumura T, Suzuki K, Fukuda A, et al. The Tokyo subway sarin attack: disaster management, Part 2: Hospital response. *Acad Emerg Med.* 1998;5:618-624.

TABLE 21-3
MANAGEMENT OF MILD TO MODERATE NERVE AGENT EXPOSURES

Nerve Agents	Symptoms	Management			
		Antidotes*		Benzodiazepines (if neurological signs)	
		Age	Dose	Age	Dose
• Tabun • Sarin • Cyclosarin • Soman • VX	• Localized sweating • Muscle fasciculations • Nausea • Vomiting • Weakness/floppiness • Dyspnea • Constricted pupils and blurred vision • Rhinorrhea • Excessive tears • Excessive salivation • Chest tightness • Stomach cramps • Tachycardia or bradycardia	Neonates and infants up to 6 months old	Atropine 0.05 mg/kg IM/IV/IO to max 4 mg or 0.25 mg AtroPen [†] and 2-PAM 15 mg/kg IM or IV slowly to max 2 g/hr	Neonates	Diazepam 0.1–0.3 mg/kg/dose IV to a max dose of 2 mg, or Lorazepam 0.05 mg/kg slow IV
		Young children (6 months old–4 yrs old)	Atropine 0.05 mg/kg IM/IV/IO to max 4 mg or 0.5 mg AtroPen and 2-PAM 25 mg/kg IM or IV slowly to max 2 g/hr	Young children (30 days old–5 yrs old)	Diazepam 0.05–0.3 mg/kg IV to a max of 5 mg/dose or Lorazepam 0.1 mg/kg slow IV not to exceed 4 mg
		Older children (4–10 yrs old)	Atropine 0.05 mg/kg IV/IM/IO to max 4 mg or 1 mg AtroPen and 2-PAM 25–50 mg/kg IM or IV slowly to max 2 g/hr	Children (≥ 5 yrs old)	Diazepam 0.05–0.3 mg/kg IV to a max of 10 mg/dose or Lorazepam 0.1 mg/kg slow IV not to exceed 4 mg
		Adolescents (≥ 10 yrs old) and adults	Atropine 0.05 mg/kg IV/IM/IO to max 4 mg or 2 mg AtroPen and 2-PAM 25–50 mg/kg IM or IV slowly to max 2 g/hr	Adolescents and adults	Diazepam 5–10 mg up to 30 mg in 8 hr period or Lorazepam 0.07 mg/kg slow IV not to exceed 4 mg

2-PAM: 2-pralidoxime
IM: intramuscular
IO: intraosseous
IV: intravenous
PDH: Pediatrics Dosage Handbook

*In general, pralidoxime should be administered as soon as possible, no longer than 36 hours after the termination of exposure. Pralidoxime can be diluted to 300 mg/mL for ease of intramuscular administration. Maintenance infusion of 2-PAM at 10–20 mg/kg/hr (max 2 g/hr) has been described. Repeat atropine as needed every 5–10 minutes until pulmonary resistance improves, secretions resolve, or dyspnea decreases in a conscious patient. Hypoxia must be corrected as soon as possible.

[†]Meridian Medical Technologies Inc, Bristol, Tenn.

Data sources: (1) Rotenberg JS, Newmark J. Nerve agent attacks on children: diagnosis and management. *Pediatrics*. 2003;112:648–658. (2) Pralidoxime [package insert]. Bristol, Tenn: Meridian Medical Technologies, Inc; 2002. (3) AtroPen (atropine autoinjector) [package insert]. Bristol, Tenn: Meridian Medical Technologies, Inc; 2004. (4) Henretig FM, Cieslak TJ, Eitzen Jr EM. Medical progress: biological and chemical terrorism. *J Pediatr*. 2002;141(3):311–326. (5) Taketomo CK, Hodding JH, Kraus DM. *American Pharmacists Association: Pediatric Dosage Handbook*. 13th ed. Hudson, Ohio; Lexi-Comp Inc: 2006.

TABLE 21-4

MANAGEMENT OF SEVERE NERVE AGENT EXPOSURE

Nerve Agents	Severe Symptoms	Management			
		Antidotes*		Benzodiazepines (if neurological signs)	
		Age	Dose	Age	Dose
• Tabun • Sarin • Cyclosarin • Soman • VX	• Convulsions • Loss of consciousness • Apnea • Flaccid paralysis • Cardio-pulmonary arrest • Strange and confused behavior • Severe difficulty breathing • Involuntary urination and defecation	Neonates and infants up to 6 months old	Atropine 0.1 mg/kg IM/IV/IO or 3 doses of 0.25mg AtroPen [†] (administer in rapid succession) and 2-PAM 25 mg/kg IM or IV slowly, or 1 Mark I [†] kit (atropine and 2-PAM) if no other options exist	Neonates	Diazepam 0.1–0.3 mg/kg/dose IV to a max dose of 2 mg, or Lorazepam 0.05 mg/kg slow IV
		Young children (6 months old–4 yrs old)	Atropine 0.1 mg/kg IV/IM/IO or 3 doses of 0.5mg AtroPen (administer in rapid succession) and 2-PAM 25–50 mg/kg IM or IV slowly, or 1 Mark I kit (atropine and 2-PAM) if no other options exist	Young children (30 days old–5 yrs and adults)	Diazepam 0.05–0.3 mg/kg IV to a max of 5 mg/dose, or Lorazepam 0.1 mg/kg slow IV not to exceed 4 mg
		Older children (4–10 yrs old)	Atropine 0.1 mg/kg IV/IM/IO or 3 doses of 1mg AtroPen (administer in rapid succession) and 2-PAM 25–50 mg/kg IM or IV slowly, 1 Mark I kit (atropine and 2-PAM) up to age 7, 2 Mark I kits for ages > 7–10 yrs	Children (≥ 5 yrs old)	Diazepam 0.05–0.3 mg/kg IV to a max of 10 mg/dose, or Lorazepam 0.1 mg/kg slow IV not to exceed 4 mg
		Adolescents (≥ 10 yrs old) and adults	Atropine 6 mg IM or 3 doses of 2 mg AtroPen (administer in rapid succession) and 2-PAM 1800 mg IV/IM/IO, or 2 Mark I kits (atropine and 2-PAM) up to age 14, 3 Mark I kits for ages ≥ 14 yrs	Adolescents and adults	Diazepam 5–10 mg up to 30 mg in 8-hr period, or Lorazepam 0.07 mg/kg slow IV not to exceed 4 mg

IM: intramuscular

IO: intraosseous

IV: intravenous

*In general, pralidoxime should be administered as soon as possible, no longer than 36 hours after the termination of exposure. Pralidoxime can be diluted to 300 mg/mL for ease of intramuscular administration. Maintenance infusion of 2-PAM at 10–20 mg/kg/hr (max 2 g/hr) has been described. Repeat atropine as needed every 5–10 min until pulmonary resistance improves, secretions resolve, or dyspnea decreases in a conscious patient. Hypoxia must be corrected as soon as possible. [†]Meridian Medical Technologies Inc, Bristol, Tenn.

Data sources: (1) Rotenberg JS, Newmark J. Nerve agent attacks on children: diagnosis and management. *Pediatrics*. 2003;112:648–658. (2) Pralidoxime [package insert]. Bristol, Tenn: Meridian Medical Technologies, Inc; 2002. (3) AtroPen (atropine autoinjector) [package insert]. Bristol, Tenn: Meridian Medical Technologies, Inc; 2004. (4) Henretig FM, Cieslak TJ, Eitzen Jr EM. Medical progress: biological and chemical terrorism. *J Pediatr*. 2002;141(3):311–326. (5) Taketomo CK, Hodding JH, Kraus DM. *American Pharmacists Association: Pediatric Dosage Handbook*. 13th ed. Hudson, Ohio: Lexi-Comp Inc; 2006.



French family at Marbach, Meurthe et Moselle, France, September 1918. Gas masks were compulsory in the village, due to nearby gas attacks. Photo is the frontispiece of the October 1921 reprint of Will Irwin's book "The Next War" (Dutton, N.Y., 19th printing Oct 1921; first published April 1921.)

J. Davidson Pratt, "Gas Defence from the Point of View of the Chemist" (Royal Institute of Chemistry, London, 1937): "... during the Great War, French and Flemish ... living in the forward areas came unscathed through big gas attacks by going into their houses, closing the doors - the windows were always closed in any case - and remaining there..."

IF THE GAS RATTLES SOUND



Put on mask, holding your breath until mask is in position. Turn up collar. Put on gloves or keep hands in pockets. Take cover in nearest building quickly. Put up umbrella if you have one.

IF YOU GET GASSED

by Vapour Gases

1. Keep your mask on even if you feel discomfort.
2. If discomfort continues, go to First Aid Post.

by Liquid or Blister Gas

1. Dab, but *don't rub* the splash with your handkerchief. Then destroy the handkerchief.
2. Rub No. 2 Ointment well into place (buy a 6d. jar now from any chemist). In an emergency, chemists will supply Bleach Cream free.
3. If you can't get the Ointment or Cream within 5 minutes, wash the affected place with soap and warm water.
4. Take off *at once* any garment splashed with gas.

HOW TO PUT ON YOUR MASK

1. Hold your breath. 2. Hold mask in front of face, thumbs inside straps. 3. Thrust chin well forward into mask. Pull straps as far over head as they will go. 4. Run finger round face-piece taking care head-straps are not twisted.



London baby gas mask tests (3 March 1939)



**Hitler will send
no warning –**

***so always carry
your gas mask***

ISSUED BY THE MINISTRY OF HOME SECURITY



Gas Raid Quiz

ISSUED BY THE MINISTRY OF HOME SECURITY

No. 17

WILL YOU BE IN
GREAT DANGER
IF A GAS RAID COMES WHEN
YOU ARE
IN A TRAIN?



ANSWER:—

NOT IF YOU HAVE
YOUR GAS MASK WITH
YOU AND PUT IT ON
IMMEDIATELY. THE GUARD
OF THE TRAIN WOULD TAKE
CHARGE AND DECIDE WHAT
WAS BEST FOR THE
PASSENGERS.

**NEVER SET OUT
ON A JOURNEY
WITHOUT YOUR
GAS MASK.**

(THIS SPACE IS PRESENTED BY WHITBREAD & CO. LTD.)

Gas Raid Quiz Leaflet (HO 186/2247)

Printed for the War Cabinet. January 1941.

SECRET.

Copy No. 28

W.P. (41) 15.

January 24, 1941.

TO BE KEPT UNDER LOCK AND KEY.

It is requested that special care may be taken to ensure the secrecy of this document.



WAR CABINET.

ANTI-GAS PRECAUTIONS.

Memorandum by Home Secretary and Minister of Home Security.

FOLLOWING the discussion at the War Cabinet* on the 20th January, 1941, I circulate the following note about anti-gas measures for the civil population. The note has been drawn up on the assumption that there should be no press and broadcast publicity about anti-gas precautions. I appreciate that there are good reasons for such a course of action, but I feel bound to say that the absence of publicity will make it more difficult to secure a rapid and widespread improvement in the preparedness of the civil population to meet a sudden gas attack. The value of a respirator, for example, lies only partly in the efficiency of the respirator itself. The balance—and no small balance—depends on the extent to which the public are practised in the habit of putting it on quickly and wearing it.

Even with the aid of advance publicity it is impossible to guarantee that the first onset of a gas attack will not result in casualties. The risk must inevitably be increased—possibly quite seriously in view of the immunity we have hitherto enjoyed—if there is no public warning of the increased likelihood of gas attack in the near future. I suggest, therefore, that the War Cabinet should review their policy in this matter.

H. M.

Home Office, January 24, 1941.

NOTE.

PERSONAL PROTECTION.

(a) *General public.*

1. Every member of the public should be in possession of a respirator. All respirators have been fitted with an additional filter known as "Contex" to increase their protection against particulate gases, i.e., arsenical smokes. There are over 10 million respirators in national reserve in addition to 3 million reserves in the hands of local authorities.

2. In March 1940 arrangements were made through the Wardens' organisation for a special inspection of respirators in the hands of the public. Local authorities were then asked to institute a system of inspection by Wardens at

* W.M. (41) 8, item 4.

regular intervals. The issue of "Contex," which began in May and continued until September, gave a special opportunity for inspection by Wardens, and there is reason to believe that this inspection was largely carried out.

3. The number of faulty respirators reported at the March 1940 inspection was surprisingly small, and the number of unserviceable respirators returned by local authorities in the period April to December 1940, was at the rate of less than 4 per cent. a year.

as the view has been taken that it was unnecessary to have decontamination squads always standing by. They are in the main drawn from the men belonging to the cleansing departments of the local authorities.

At present these men are reserved by reason of their primary occupation at 25, but it is proposed by the Man-Power Committee and the Ministry of Labour and National Service to raise the age to 35. It will be necessary therefore that there should be some deferment of the calling-up of a proportion of the men under 35, and discussions are already taking place on this with the Ministry of Labour.

ANTI-GAS PRECAUTIONS IN SHELTERS.

17. In July 1940, instructions were issued that arrangements should be made for securing that public shelters could be made gas-proof. Now that shelters are being used for sleeping, adequate ventilation is of the first importance. It is impracticable to reconcile this with efficient gas-proofing. Local authorities are therefore being informed that further steps to provide gas-proofing in naturally ventilated shelters should not be taken for the present and that reliance must be placed on the respirator as the first line of defence.



London 1941 baby gas mask drill

What to do about **GAS**



*In a gas attack, first put on
your own mask, then you will
be better able to help baby.*

HINTS TO MOTHERS

★ Learn to put on baby's gas helmet quickly, while wearing your own mask. Your Health Visitor will show you how. If you don't know her address ask at Town Hall or at the Child Welfare Centre.

★ With more than one baby you need help. Arrange with a neighbour, or find out if your local W.V.S. has a Housewives' Service.

★ Toddlers soon learn to put on their own masks. Let them make a game of it and they will wear their gas masks happily.

**MAKE SURE YOUR FAMILY
HAVE THEIR GAS MASKS
WITH THEM NIGHT & DAY**

**Hand pumped
(asthmatic)**



Baby's



Hospital patient's



**Police
/warden**



Civilian



**Soldier's
until 1942**



**Small child's
(Mickey Mouse)**

**An eminent chemist
gives the facts about poison gas
and air bombing**

Breathe Freely!

THE TRUTH ABOUT POISON GAS

by
James Kendall

M.A., D.Sc. F.R.S.

Professor of Chemistry, University of Edinburgh

The civilian has been told that he will have to bear the brunt of another war, that within a few hours from the outset enemy bombers will destroy big cities and exterminate their inhabitants with high explosive, incendiary and gas bombs. What is the truth?

Here, in this book, written in language everyone can understand, is the considered opinion of an authority on chemical warfare.

Breathe Freely !

THE TRUTH ABOUT POISON GAS

JAMES KENDALL

M.A., D.Sc., F.R.S.

Professor of Chemistry in the University of Edinburgh ;
formerly Lieutenant-Commander in the United
States Naval Reserve, acting as Liaison Officer
with Allied Services on Chemical Warfare

1938

52

GAS IN THE LAST WAR

CASUALTIES IN INITIAL GAS ATTACKS

<i>Gas</i>	<i>Date</i>	<i>Amount Used In Tons</i>	<i>Lethal Concentra- tion *</i>	<i>Non-fatal injuries</i>	<i>Deaths</i>
Chlorine	Apr. 22, 1915	168	5.6	15,000	5,000
Phosgene	Dec. 19, 1915	88	0.5	1,069	120
Mustard	July 12, 1917	125	0.15	2,490	87

(* mg/litre for 10 minutes exposure unprotected)

between September 15 and November 11, 1918, 2,000,000 rounds of gas shell, containing 4,000 tons of mustard gas, were fired against the advancing British troops; our losses therefrom were 540 killed and 24,363 injured. Gas defence had progressed to the point where it took nearly 8 tons of mustard gas to kill a single man !

A GAS ATTACK ON LONDON

109

The first salvo of gas shells often reaches the trenches before the occupants don their masks, whereas the Londoner will receive ample warning of the approaching danger.

110

GAS IN THE NEXT WAR

The alarmist and the ultra-pacifist love to quote the fact that one ton of mustard gas is sufficient to kill 45,000,000 people. This would indeed be true if the 45,000,000 people all stood in a line with their tongues out waiting for the drops to be dabbed on, but they are hardly likely to be so obliging. One steam-roller would suffice to flatten out all the inhabitants of London if they lay down in rows in front of it, but nobody panics at the sight of a steam-roller.

EVER since the Armistice, three classes of writers have been deluging the long-suffering British public with lurid descriptions of their approaching extermination

These three classes are pure sensationalists, ultra-pacifists and military experts.

12

PANIC PALAVER

perpetrators of such articles may not recognize themselves that what they are writing is almost entirely imaginary, but they do want to get their manuscript accepted for the feature page of the *Daily Drivel* or the *Weekly Wail*. In order to do that, they must pile on the horrors thick, and they certainly do their best

The amount of damage done by such alarmists cannot be calculated, but it is undoubtedly very great.

poison gas has a much greater news value. It is still a new and mysterious form of warfare, it is something which people do not understand, and what they do not understand they can readily be made to fear.

13

The recent film *Things to Come*, in particular, has provided a picture of chemical warfare of the future which shows how simply and rapidly whole populations will be wiped out. Millions of people, perhaps, have been impressed by the authority and reputation of Mr. H. G. Wells into believing that this picture represents the plain truth.

17

EXHIBIT 'B' is the work of the ultra-pacifist. He abominates war and everything connected with war to such an extent that he paints a highly coloured picture of its horrors, in the most extreme Surrealistic style, with the object of frightening the public to the point where they will relinquish, in the hope of escaping war, even the right of self-defence. His motives may be praiseworthy, but his methods are to be deplored.

*Any communication on the subject
of this letter should be addressed to—*

THE UNDER SECRETARY OF STATE,
HOME OFFICE (A.R.P. DEPT.),
HORSEFERRY HOUSE,
THORNEY STREET,
LONDON, S.W.1.



HOME OFFICE,

AIR RAID PRECAUTIONS DEPT.,
HORSEFERRY HOUSE,
THORNEY STREET,
LONDON, S.W.1.

and the following number quoted :—
701,602/109

31st December, 1937.

SIR,

Experiments in Anti-Gas Protection of Houses

I am directed by the Secretary of State to transmit, for the information of your Council, the annexed Report describing in detail the experiments to which reference was made by the Parliamentary Under Secretary of State in his speech on the second reading of the Air Raid Precautions Bill in the House of Commons on the 16th November.

The experiments were conducted by the Chemical Defence Research Department under the aegis of a special Sub-Committee of the Chemical Defence Committee. That Sub-Committee was composed of eminent experts not in Government employment, and included a number of distinguished University professors and scientists.

I am,
Sir,
Your obedient Servant,
R. R. SCOTT.

The Clerk of the County Council.

The Town Clerk.

The Clerk to the District Council.

Issued to all

County Councils

*County Borough Councils (and the Corporation of the City of
London)*

Metropolitan Borough Councils

Municipal Borough Councils

Urban and Rural District Councils

in England and Wales

*Copies sent for information to Chief Officers of Police in
England and Wales.*

PROTECTION AGAINST GAS

REPORT OF EXPERIMENTS CARRIED OUT BY THE CHEMICAL DEFENCE RESEARCH DEPARTMENT

Handbook No. 1 issued by the Air Raid Precautions Department of the Home Office describes the steps which the public are advised to take in order to protect themselves against the effects of any chemical warfare gases which might be employed by enemy aircraft in time of war.

The gist of these recommendations is:—

First, to go indoors.

Secondly, to arrange for the room into which you go to be made as gas-proof as possible.

Thirdly, to take with you the respirator which will have been issued to you.

Whilst it has never been claimed that any one of these steps by itself will make an individual completely safe, experiments and trials have shown that each of these measures is by itself of considerable value and that when all of them are adopted a very high degree of protection is obtained. An outline is given below of certain typical experiments which have been carried out.

These particular experiments were carried out with four different types of actual war gas. The first four experiments to be described will show the degree of protection that is obtained from each type of gas merely by going indoors and shutting the doors and windows.

As explained in Handbook No. 1*, a chemical warfare gas may be dropped from aircraft either as spray or in bombs. In the former case the liquid drops fall like rain, and it is obvious that by going indoors the public will avoid them. On the other hand, if gas bombs are dropped, people who have gone indoors will avoid being splashed by the chemical in the bomb, and even in an ordinary room they will receive some protection from the gas cloud. The amount of protection obtained in a house which has not been treated in any way can be gathered from the following experiments.

(a) *Protection obtained in a house which has not been treated in any way.*

The house employed was a gamekeeper's cottage with three rooms on the ground floor and three rooms upstairs. It had been unoccupied for about 15 years but was in a reasonable state of repair. It was to a large extent sheltered by belts of

* A.R.P. Handbook No. 1, "Personal Protection against Gas", price 6d. (8d. post free) : published by H.M. Stationery Office (see back page).

trees which reduced the strength of the wind in the vicinity of the cottage to about one-eighth of that in the open. In this respect therefore the location of the cottage resembled a house in a town. In one experiment over a ton of actual chlorine gas was released 20 yards from the house so that the wind carried it straight on to the unprotected room. A very strong gas cloud was thus maintained outside the house for about 40 minutes, during which time the gas gradually penetrated to the inside. A fire was burning in the hearth the whole time, and the only measures taken to exclude the gas consisted of closing the doors and windows in the normal way.

Human beings who occupied this unprotected room found that gas penetrated slowly into the room, and after about seven minutes it became necessary for them to put on their respirators. Had these men been outside the house, they would have been compelled to put on their respirators immediately, since otherwise the very intense gas cloud would have caused instantaneous incapacitation and ultimate death.

If the gas, which with its containers weighed about $2\frac{1}{2}$ tons, had been released more quickly, the strength of the gas cloud would have been greater but the time during which the house was enveloped by it would have been correspondingly shorter.

It is important to appreciate properly the severity of this trial. The quantity of gas concentrated on this house could under practical conditions only be obtained by several large bombs dropping very close to the building. The period of exposure to the maximum effects of the gas was also many times longer than would normally be experienced under most practical conditions, since the initial cloud from a gas bomb soon begins to be diluted and dispersed by the action of even quite moderate winds. It is clear that conditions similar to those of the experiment are extremely severe, and are such as would be likely to occur very rarely indeed and to a very small number of houses.

It should also be noted that the cottage used in this experiment had no carpets or other floor coverings. Most of the gas which leaked in came through the spaces between the floor boards, and it is therefore clear that much less would have got into an ordinary room in which there was a carpet, linoleum, or a solid floor.

In another experiment the house was surrounded at a distance of 20 yards by large shallow trays which were filled with mustard gas, the trays being spaced a few yards apart. By this means the vapour given off by the mustard gas was carried on to the house no matter how the direction of the wind varied. As the weather at the time was not very warm, the conditions of the experiment were made more severe by producing a fine spray of mustard gas at a point 10 yards to windward of

the house so that the house was enveloped in the resultant cloud of mustard gas for a period of an hour. The cloud produced in this way was about a hundred times as strong as that caused by the evaporation of the mustard gas from the trays. Animals were placed in an unprotected room in the house and remained there during the spraying period and for a further 20 hours while the house was subjected to the vapour of mustard gas given off from the trays. Observations made upon the animals during the three subsequent days and also post mortem examination showed that none of them was seriously harmed by the mustard gas.

The third type of gas used was tear gas. In this experiment the same cottage was enveloped for an hour in an intense atmosphere of tear gas produced by spraying the gas into the air at a point 10 yards upwind of the house. Men who were stationed 200 yards downwind from the house and in the track of the gas cloud were incapacitated in about a minute, and in some cases in 20 seconds. On the other hand, men who occupied rooms in the house which had received no treatment beyond the closing of the windows and doors found no need to put on their respirators for the first 13 minutes. The tear gas gradually penetrated into these unprotected rooms, although after three-quarters of an hour the strength of the gas inside the house was still very much less than that outside.

In the fourth experiment the cottage was enveloped for 20 minutes in a dense cloud of arsenical smoke. Men occupying an unprotected room of the house found that the arsenical smoke penetrated into the room, but the strength of the cloud inside was much less than that outside. When Civilian respirators were worn in this room, complete protection was obtained. Men who were stationed 200 yards downwind of the house and in the path of the gas cloud were rapidly affected, but when they wore Civilian respirators no effects were felt.

The above four examples clearly demonstrate that, apart from the protection which a house provides against falling airplane spray, some measure of protection is afforded even by an ordinary unprotected room against gas clouds such as are produced by bombs close to the building.

(b) *Protection afforded by a house treated in accordance with Air Raid Precautions Handbook No. 1.*

A brief account will now be given of four further experiments with the same four war gases in order to illustrate the added protection which can be obtained by treating a room in accordance with the instructions given in Air Raid Precautions Handbook No. 1. These experiments were also conducted with the cottage already mentioned. The room selected for treatment was situated on the ground floor on the windward side

of the house so that it was subjected to the full effect of the gas and the wind. It measured about 12 feet square. The Air Raid Precautions instructions for excluding gas were carried out by unskilled men, the official procedure being rigidly followed. As the house was not provided with carpets or other floor covering, it became necessary to seal up the joints between the boards over the whole of the floor of the selected room. This was done by pasting strips of paper along the joints between the floor boards. Some of these strips became displaced by the boots of the men who were inside the room, and an appreciable leakage of gas into the room undoubtedly occurred due to this cause. Two tons of chlorine were released 20 yards from the house, the time of emission being an hour. Animals were placed in the house, some in the "gas protected" room and others in rooms which had received no such treatment. The latter set of animals were killed by the gas which penetrated into the unprotected rooms under these very severe conditions. The animals in the "gas protected" room, however, were unaffected and remained normal, notwithstanding the severity of the trial.

An experiment with mustard gas, similar to that already described, was also carried out after the ground floor room on the windward side of the house had been treated in accordance with the Air Raid Precautions Department's procedure. Animals were placed in the room, which was then subjected to the same exposure of mustard gas spray and vapour as before. At the end of 20 hours the animals were removed and a most thorough examination of them showed no evidence of the effects of the gas at all. Animals placed outside the house during the first hour of the experiment were, of course, very seriously affected. The amount of mustard gas penetrating into the room was also measured by chemical methods and it was found that the amount of gas inside the room was so small that a man could have remained there for the whole 20 hours without its being necessary for him to wear a respirator and without any subsequent ill-effects.

The experiment with tear gas previously described was also performed against the "gas protected" room. A number of men occupied this room and found they were able to remain there without its being necessary for them to put on their respirators at any time during the hours that this very severe experiment lasted.

An experiment with arsenical smoke, similar to that already described, was also carried out against the "gas protected" room. The occupants found that the arsenical smoke penetrated the room to an extent which caused some irritation of the nose and throat and eventually rendered the wearing of respirators desirable to ensure comfort. After putting on the respirator, no

discomfort was felt throughout the remainder of the experiment. Men who left the " gas protected " room wearing their Civilian respirators were able to traverse the densest part of the cloud without discomfort. Under these severe conditions the presence of the arsenical smoke could be detected, but the effects were insignificant.

It is important to appreciate fully the severity of the conditions imposed in the two trials with arsenical smoke. A very high concentration of the irritant smoke was maintained around the house for 20 minutes. Under practical conditions such a high concentration could be produced only by a large and efficiently designed bomb falling close to the building, and then only for a short period. The conditions of the trials were therefore extremely severe and represent a situation which would only rarely be met, and in which only a small number of houses would be involved.

From this second series of experiments it will be seen that treating a room in accordance with the recommendations of the Air Raid Precautions Department does reduce very considerably the amount of gas penetrating into the room, and that a room so treated is correspondingly safer than a room which has received no such treatment.

Indeed, in the case of the experiments with mustard gas and tear gas, the amount of gas which was able to penetrate into the gas protected room was so small that no further measures of protection were necessary.

In the experiment with chlorine, although the amount of gas which entered the treated room was insufficient to injure the animals, human beings who occupied the room during this extremely severe test could smell the gas. They were provided with Civilian respirators, and they found that by putting these respirators on they were completely protected against every trace of gas. Some of these individuals then left the " gas protected " room, passed out of the house, and traversed the lethal cloud of gas which enveloped it. Although they deliberately stood in the densest part of the cloud for some minutes, no trace of the gas passed through their respirators.

Similarly the experiments with arsenical smoke show that although, under the most severe conditions, the cloud may penetrate into the " gas protected " room in sufficient quantity to be detected, or even to cause some irritation, the effects are materially reduced in a room so treated. It is also demonstrated that wearing a Civilian respirator affords complete protection against any smoke which may gain access to the room. The respirator also enabled individuals to pass through an extremely dense cloud of arsenical smoke in complete safety.

The experiments which have been outlined in this statement were purposely designed to represent the most severe conditions likely to be met. The results all combine to show that if the instructions given in Air Raid Precautions Handbook No. 1 are carried out a very high standard of protection is obtained. With regard to the first precaution it has been shown that going indoors and closing the doors and windows affords some measure of protection, even though the room occupied has not been specially prepared. In these circumstances there is ample time to put on the respirator at leisure if this should be necessary. If the second precaution of rendering the room as gas-proof as possible has been carried out, then the occupants will normally be able to remain in complete safety and comfort without further protection. Under the most severe conditions sufficient gas may penetrate such protected rooms to be recognized or even to cause slight irritation. When this occurs the respirator can be put on though in many cases this will be as a matter of convenience and extra precaution rather than real necessity. With regard to the Civilian respirator it has been shown that this will, in conjunction with the above precautions, provide complete safety for any period for which it is likely to be required. It has further been demonstrated that this respirator will enable the wearer to reach a place of safety even if he should for a time be exposed to the most dangerous situation—for example if he is caught out of doors in a gas cloud, or if his gas-protected room becomes damaged and he is compelled to seek shelter elsewhere.

LONDON

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HOME OFFICE
CIVIL DEFENCE

Manual of Basic Training
VOLUME II

BASIC
CHEMICAL WARFARE

PAMPHLET No. 1

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1949

CHAPTER VII

51. COLLECTIVE PROTECTION

Every individual can rely on his respirator for his own protection against war gas, and this is his primary defence, but the protection which is afforded against vapour, by buildings in sound condition, is of considerable value and against liquid and spray is complete.

~~TOP SECRET~~
UNCLASSIFIED NO. 1 193
ASSISTANT DIRECTOR
FOR
NATIONAL INTELLIGENCE ESTIMATES

NATIONAL INTELLIGENCE ESTIMATE

THE PROBABILITY OF SOVIET EMPLOYMENT OF BW AND CW IN THE EVENT OF ATTACKS UPON THE US

CIA HISTORICAL REVIEW PROGRAM
RELEASE IN FULL



NIE-18

Published 10 January 1951

CENTRAL INTELLIGENCE AGENCY

APPENDIX B

GA AND GB NERVE GASES

1. **GENERAL.** GA and GB are colorless, odorless, low viscosity liquids, somewhat more volatile than kerosene. They become effective anti-personnel agents when dispersed as a vapor or invisible fog. GB is approximately $2\frac{1}{2}$ times more toxic than GA.
2. **QUANTITIES REQUIRED FOR EFFECTIVE EMPLOYMENT.**
 - 2.1 **MILITARY ATTACK.**
 - 2.11 Approximately 5 tons of GB used in present munitions would be required to obtain a concentration for 50% lethality, in an open area of one square mile, under favorable weather conditions as described in paragraph 2.14 below. Theoretically, some $2\frac{1}{2}$ times more GA would be required for comparable effectiveness. However, dissemination of GA by munitions to date does not approach this ideal and 15 to 20 times more GA than GB may be needed for 50% lethality.
 - 2.12 The quantities of GA and GB delivered on the target in a military attack may well be sub-lethal. However, even with as little as $1/10$ of the lethal quantity, effective incapacitation and demoralization can be obtained.
 - 2.13 Inasmuch as the nerve gases are anti-personnel weapons they would be employed against population centers and military and industrial installations where the objective is primarily incapacitation of personnel as contrasted with physical destruction. However, CW may also be employed to supplement AW and high explosives.
 - 2.14 Effective dissemination of GA and GB against the foregoing targets requires the following conditions.
 - 2.141 Low or medium wind velocity.
 - 2.142 Shallow layer of cool air below a warm layer.
 - 2.143 Openings in the buildings through which outside air can penetrate, such as windows or air conditioning inlet ducts (openings can be obtained by employing high explosive munitions concurrently with CW agents).
 - 2.15 The atmospheric conditions usually present on many cloudy days and at times when inversion is present are suitable for a gas attack. Night conditions in times of fair weather are generally more favorable for a CW attack than day conditions. Sunny, hot days in summer time with little or no wind are unsuitable and the use of toxic agent clouds at these times would be inefficient.
 - 2.2 **SABOTAGE ATTACK.**
 - 2.21 When effectively disseminated throughout a confined space of 100,000 cubic feet, about one ounce of GA or about one-half ounce of GB are sufficient to incapacitate or kill substantially all of the people in the area. The most likely method of dissemination would be by means of an aerosol bomb type container similar to those used for insecticides. These bombs operate with an auxiliary volatile liquid, which together with the weight of the container would make the weight of the dispenser about five times the weight of the agent; that is, for 100,000 cubic feet the dispenser would weigh about $\frac{1}{4}$ pound.

~~TOP SECRET~~

2.22 In the case of the Pentagon, which has 75,000,000 cubic feet of enclosed space, 50 lbs of GA or 20 lbs of GB would have to be dispersed throughout the building to cause the above results, assuming no significant extraction by the air conditioning system. This would require 50-10 pound bombs of about 0.6 gallon capacity for GA. Fewer bombs or smaller ones in the ratio of 2-½ to 1 would be needed for GB.

3. EFFECTS PRODUCED AND PROTECTIVE MEASURES.

3.1 GA and GB produce characteristic physiological effects, such as, contraction of the pupil of the eye, twitching eyelids, tightness of the chest, difficulty in breathing, blurring of vision, twitching of muscles, headache, nausea, vomiting, salivation and diarrhea. In the case of a lethal dose, the victim loses muscular power and coordination. In addition to intensification of the foregoing effects, convulsions occur and there is involuntary defecation and urination; distressed breathing; paralysis; unconsciousness; heart slowing, dilating and eventually stopping due to heart muscle failure and asphyxia. In general, death occurs within an hour after exposure to the lethal concentration.

3.2 The physiological effects are greatest when absorbed through the respiratory system following inhalation of the vapors. However, the same effects can be produced by larger doses through mucous membranes, open wounds, and even by a small drop of the liquid touching the skin. The liquid will penetrate ordinary clothing.

3.3 Theoretically, complete protection against the nerve gases requires not

only a well fitted gas mask but also special impermeable clothing. However, except in the immediate vicinity of bursts, the concentrations which probably will be encountered will be such that gas masks will provide adequate protection for all but a few of the personnel in the target area. On the other hand, at present there is no quick method of detection of GA and GB for warning and identification.

3.4 GA and GB are easily decomposed by any acid and they hydrolyze very rapidly in alkaline solutions. Effective decontamination can be carried out with alcohol solutions of sodium and potassium hydroxide, and solutions or pastes of washing soda, lime bleach, and baking soda. Even scrubbing with soap and water is effective to a degree.

3.5 Immediate injection of atropine is extremely effective in counteracting the physiological effects of these gases.

4. REFERENCES.

Additional information which may be of assistance to civil defense planning will be found in the following:

4.1 Presentation to the Secretary of Defense's Ad Hoc Committee on CEBAR 27 January 1950. Submitted by Office of Chief, Chemical Corps.

4.2 Report of the Ad Hoc Committee on BW, CW, and RW (Stephenson Committee) to the Secretary of Defense, 30 June 1950.

4.3 Summary Technical Report of NDRC Division 9, Volume 1, Parts I & II and Division 10, Volume I, Part II.

4.4 Chemical and Toxicologic Data on CW Agents by E. L. Wardell and C. A. Rouiller, Information Branch, Technical Service Division, Office of the Chief, Chemical Corps, 25 May 1948.

UNITED STATES NAVY

**ABC
WARFARE DEFENSE
ASHORE**



TECHNICAL PUBLICATION

NAVDOKS-TP-PL-2

REVISED

APRIL 1960

**DEPARTMENT OF THE NAVY
BUREAU OF YARDS AND DOCKS
WASHINGTON 25, D. C.**

TABLE 3-2**Median Lethal and Median Incapacitating Dosages for Selected War Gases**

Name and symbol	Median lethal dosage (mg-min/m³)	Median incapacitating dosage (mg-min/m³)
Tabun (GA)	400 for resting men	300 for resting men
Sarin (GB)	100 for resting men	75 for resting men
Soman (GD)	GB, GA range	GB, GA range
Distilled mustard (HD)	600 to 1,000 by inhalation; 10,000 by skin exposure	200 by eye effect; 2,000 by skin effect
Nitrogen mustard (HN-1)	1,500 by inhalation; 20,000 by skin exposure	200 by eye effect; 9,000 by skin effect
Nitrogen mustard (HN-2)	3,000 by inhalation	Less than HN-1, but more than HN-3
Nitrogen mustard (HN-3)	1,500 by inhalation; 10,000 by skin exposure (estimated)	200 by eye effect; 2,500 by skin effect (estimated)
Mustard (H)	600 to 1,000 by inhalation; 10,000 by skin exposure	200 by eye effect; 2,000 by skin effects
Lewisite	1,200 to 1,500 by inhalation; 100,000 by skin exposure	300 by eye effect; 1,500 by skin effect
Phosgene (CG)	3,200	1,600
Cyanogen Chloride (CK)	11,000	7,000
Hydrogen Cyanide (AC)	Approximately 2,600	Approximately 2,600

The level to which the contamination must be reduced depends on the CW agent that is employed and the type of protective gear that is provided. For example, the Lct 50 respiratory dose from GB is 100 mg-min/m³, while the Lct 50 dose through the skin of an unclothed person is 12,000 mg-min/m³, and the Lct 50 dose through the skin of a person wearing ordinary clothing is 15,000 mg-min/m³. Thus, if personnel can wear masks and still carry out their mission, decontamination need not be as complete as if they did not wear masks.

TABLE 4-2
RW Contamination

Building surfaces or paved areas	1 hour Radiation dose rate (r/hr)	Residual
		Firehosing or street flushing
Asphaltic concrete	300	0.07
	1,000	0.03
	3,000	0.01
Portland cement concrete	300	0.04
	1,000	0.02
	3,000	0.008
Tar-and-gravel roofing	300	0.03
	1,000	0.02
	3,000	0.01
Composition roofing	300	0.04
	1,000	0.03
	3,000	0.01
Wood shingle	300	0.17
	1,000	0.10
	3,000	0.04
Galvanized corrugated steel	300	0.05
	1,000	0.02
	3,000	0.006
Smooth painted surface	300	0.04
	1,000	0.01
	3,000	0.004

HOME OFFICE

SCIENTIFIC INTELLIGENCE OFFICERS'

OPERATIONAL NOTES

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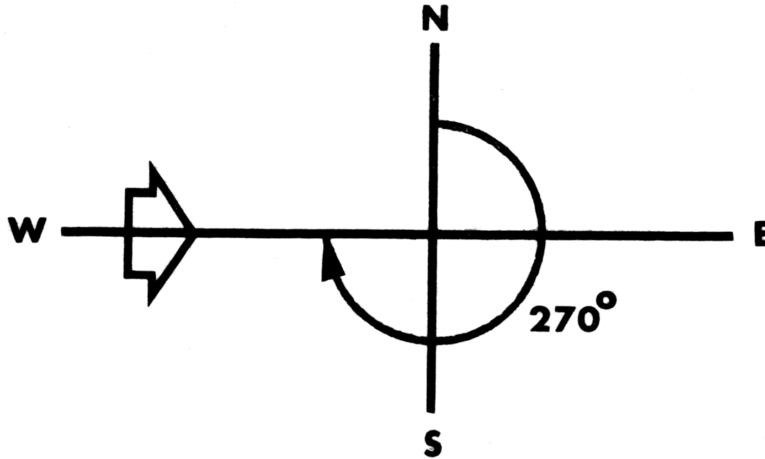
The information given in this document is not to be communicated, either directly or indirectly, to the Press or to any person not authorised to receive it.

Mechanism of fallout

Definitions

Wind direction is the direction from which the wind blows, and is given in degrees measured clockwise from north.

E.g. A 270° wind blows from the west.



Wind speed is actually measured in knots, but the unit of speed usually used by the SIO is the mile per hour (mph).

1 knot = 1 nautical mile per hour

1 nautical mile = 6080 feet

1 knot = 1.15 mph

N.B. In meteorological forecasts received by the SIO wind speeds will normally be in mph. If a forecast is mistakenly transmitted in knots, then the SIO should transform, using the above relationship. In approximate calculations the difference between a knot and a mile per hour may be neglected.

Winds changing direction with time

- (a) If a wind turns clockwise it is said to be veering.
- (b) If a wind turns anticlockwise it is said to be backing.

A forecast concerns meteorological data only.

A prediction indicates where fallout may go. It is based on a forecast and on bomb data.

A micron (μ) is one millionth of a metre.

1000 microns = 1 millimetre.

Useful wind data

The following data applies to the 0-60,000, 0-70,000 and 0-80,000 feet mean vector winds.

(a) Variation with speedProbabilities of occurrence of speeds (all directions)

Speed range (mph)	0-7	7-18	18-35	35+
Percentage probability	4	17	36	43

(b) Variation with directionProbabilities of directions occurring in 60° sectors (all speeds)

Wind direction (degrees)	0-60	60-120	120-180	180-240	240-300	300-360
Percentage probability	7	4	5	17	41	26

(c) Angular wind shear

This is defined for the present purpose as the angle which includes the directions of all the mean vector winds up to the 0-90,000 feet one, excluding the surface wind. This angle will give a very crude idea of the amount of lateral spreading which might occur in the fallout pattern.

Percentage probability of occurrence of angular shear

Angular shear (degrees)	Mean vector wind speed (mph)				Total
	0 - 7	7 - 18	18 - 35	35 +	
0-15	0	2½	9½	21	33
15-30	½	3½	13	11	28
30-75	½	7	10½	10	28
75 +	3	4	3	1	11
Total	4	17	36	43	100

ON4:2

Mode of decay

Any single radioisotope decays according to an exponential law $N_t = N_0 e^{-\lambda t}$, where N_0 and N_t are the number of atoms present initially and at time t . λ is a decay constant and can be shown to equal $0.693/T$, where T is the half-life of the isotope, i.e. if the activity was originally, say, 8 units, then it will have decayed to 4 units after time T , 2 units after time $2T$, 1 unit after time $3T$, etc.

Fission products from a nuclear explosion are a mixture of over 200 different radioisotopes with half-lives varying from fractions of a second to many thousands of years. Many of them, moreover, are not produced immediately but are the result of the decay of other nuclides. In addition, the mixture may contain some activity due to neutron activation of the bomb components resulting in the formation of neptunium 239. The decay of this mixture is not exponential and thus cannot be described by a half-life. From nuclear weapons trials it has been found for the first 100 days to follow approximately the $t^{-1.2}$ power law, i.e. $R_t = R_1 t^{-1.2}$, where R_1 and R_t are the dose-rates at 1 hour and t hours after detonation

Factors upsetting normal decay

Probable causes of deviation from the $t^{-1.2}$ decay law are:-

- (a) fractionation
- (b) neutron activation of soil elements
- (c) weathering
- (d) rigging or salting of weapons

Fractionation

This is a complex condensation process and is by no means fully understood. Its effect is to give the close-in FO a different composition and hence a different decay from the more distant FO downwind. For example, close-in FO has been found to contain less strontium 90.

Two likely causes of fractionation are:-

- (a) as the fireball cools the nuclides with the higher boiling points condense first and do so while the larger particles forming the close-in FO are still present in the cloud. The more volatile nuclides condense later when the larger particles have left the cloud and so tend to contaminate the lighter particles which are carried further downwind.

(b) certain of the fission products are inherently gaseous (e.g. krypton) or have gaseous precursors (e.g. caesium 137). The heavier particles fall out before these nuclides have decayed to non-gaseous daughters capable of condensing on to them. Close-in FO is therefore deficient in these elements. Conversely the smaller particles forming the more distant FO are enriched in them.

Neutron activation of soil elements

For FO to be produced on a substantial scale, the explosion must take place on or near the ground, in which case the radioactivity from the fission products and the bomb materials is supplemented by neutron-induced activity from certain elements in the soil. For the 50% fission weapon this extra activity is small but may be appreciable for the so-called "clean" bomb where possibly only 10% of the total energy is from fission. The number of spare neutrons is doubled and the fission product activity reduced by a factor of 5. Under these circumstances induced activity can become a substantial proportion of the whole. Calculations made on typical UK soils show that the elements most likely to contribute to this activity are sodium and manganese. Under neutron activation these form the gamma emitters sodium 24 and manganese 56. Sodium and manganese are present in soils in varying amounts according to the locality. Sodium, for example, is more abundant in the rock-salt areas of Cheshire and in regions of igneous rock formation. Manganese is fairly uniformly distributed but usually only in small amounts.

If a large quantity of a particular isotope such as sodium 24 is added to a fission product mixture obeying the $t^{-1.2}$ law, the effect is to increase the dose-rate by an amount varying with time. It can be shown that the isotope exerts its maximum proportional effect at a time equal to 1.73 times its half-life. For sodium 24 and manganese 56 the details are:-

Isotope	Half-life (hours)	Time of maximum proportional effect (hours)
Na24 Mn56	15 2 $\frac{1}{2}$	26 4 $\frac{1}{2}$

For a 10% fission bomb the sodium 24 contribution to the total DR at H + 26 hours could be over 80% for some bomb designs and soil constitutions; the manganese 56 contribution at H + 4 $\frac{1}{2}$ hours could be over 10%.

Notes on BW and CWGeneral

Toxicological warfare can consist either of a tactical attack with chemical weapons producing an immediate incapacitating effect, or of a strategic attack with biological weapons which have a delayed effect.

The new Civilian Respirator (C7), with pneumatic tube face fitting which is comfortable for long periods of wearing, affords excellent protection against BW and CW attacks.

BW

In attacks on populations, since the airborne hazard is the main one, only agents of high infectivity and high virulence (i.e. a small number of organisms required to produce infection and cause severe illness), combined with viability for many hours in the atmosphere, are likely to prove effective.

Some representative pathogenic micro-organisms

Bacterial	{	Anthrax	(lethal, very persistent spores but relatively low infectivity)
		Brucellosis	(incapacitating)
		Tularaemia	(incapacitating or lethal)
	*	Rickettsial	Q fever (like typhus)
	*	Viruses	Encephalomyelitis (brain fever) Smallpox (epidemic)

ON23:2

Personal protection

Respirators and discardible covers for head and body may be used. Extreme personal cleanliness is necessary. Total dosage can be reduced very considerably in a closed room in a house by sealing window cracks and door gaps before the arrival of contamination and ventilating the room fully as soon as it has passed.

Decontamination

Where appropriate the following measures may be taken:-

- (a) weathering for a few days will destroy most bacterial agents other than anthrax spores
- (b) use of bleach solution
- (c) scattering petrol and firing it on open contaminated ground.

CW

Mustard gas and anticholinesterase agents (persistent and non-persistent nerve gases) are the CW agents most likely to be encountered in a tactical battle.

Building/ Vehicle Type	Air Exchange Rate (ACH)	Time Building Is Exposed (hr.)	Time of Occupancy from Cloud Arrival (hr.)	Shielding Factor
Residential Building (Windows Closed) ¹	0.53	0.25	0.25	15.8
	0.08-3.24	0.25	0.25	100.7-3.2
Residential Building (Windows Open) ¹	6.4	0.25	0.25	2.0
Nonresidential Building ¹	1.285	0.25	0.25	6.9
	0.3-4.1	0.25	0.25	27.3-2.7
Vehicle ¹ Mass-Transit Vehicle ¹ Stationary Automobile ² : Windows Closed/No Ventilation Windows Closed/Fan On Recirculation Windows Open/No Ventilation Windows Open/Fan On Fresh Air	36	0.25	0.25	1.1
	1.8-5.6	0.25	0.25	5.1-2.2
	1.0-3.0	0.25	0.25	8.7-3.4
	1.8-3.7	0.25	0.25	5.1-2.9
	13.3-26.1	0.25	0.25	1.4-1.2
	36.2-47.5	0.25	0.25	1.1

¹ Ted Johnson, A Guide to Selected Algorithms, Distributions, and Databases used in Exposure Models Developed by the Office of Air Quality Planning and Standards (Chapel Hill, NC: TRJ Environmental, Inc., 22 May 2002), <http://www.epa.gov/ttn/fera/data/human/report052202.pdf>. Accessed 8 January 2008.

² J. H. Park et al., "Measurement of Air Exchange Rate of Stationary Vehicles and Estimation of In-Vehicle Exposure," Journal of Exposure Analysis & Environmental Epidemiology 8, no. 1 (January–March 1998):65-78.



**OAK RIDGE
NATIONAL
LABORATORY**

MARTIN MARIETTA

**Technical Options for
Protecting Civilians from
Toxic Vapors and Gases**

C. V. Chester

Date Published - May 1988

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

Prepared for
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for
CHEMICAL MUNITIONS
Aberdeen Proving Grounds, Maryland

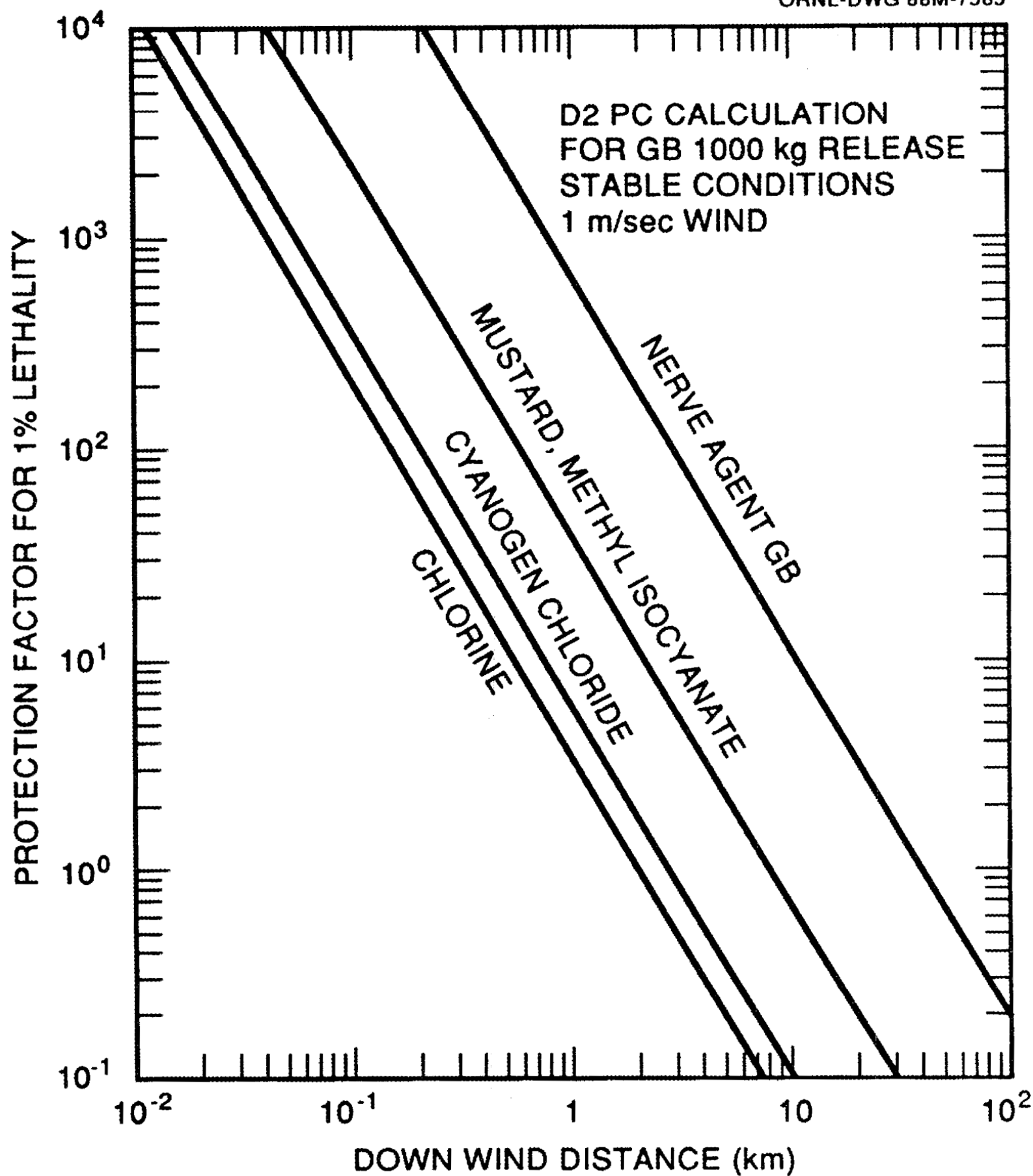


Fig. 1 Dose vs Downwind Distance for Some Very Toxic Gases

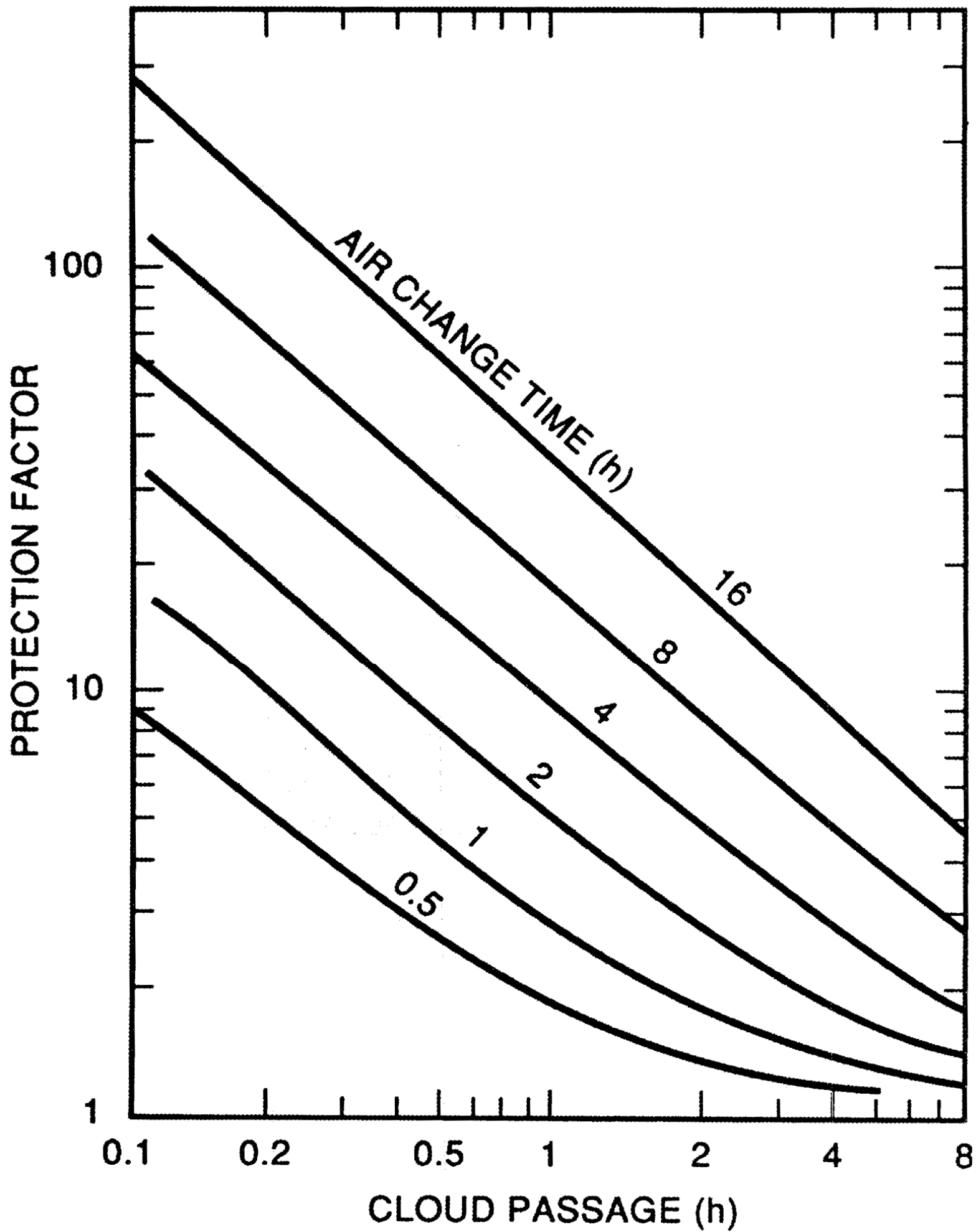


Fig. 2 Protection Factor of Leaky Enclosures

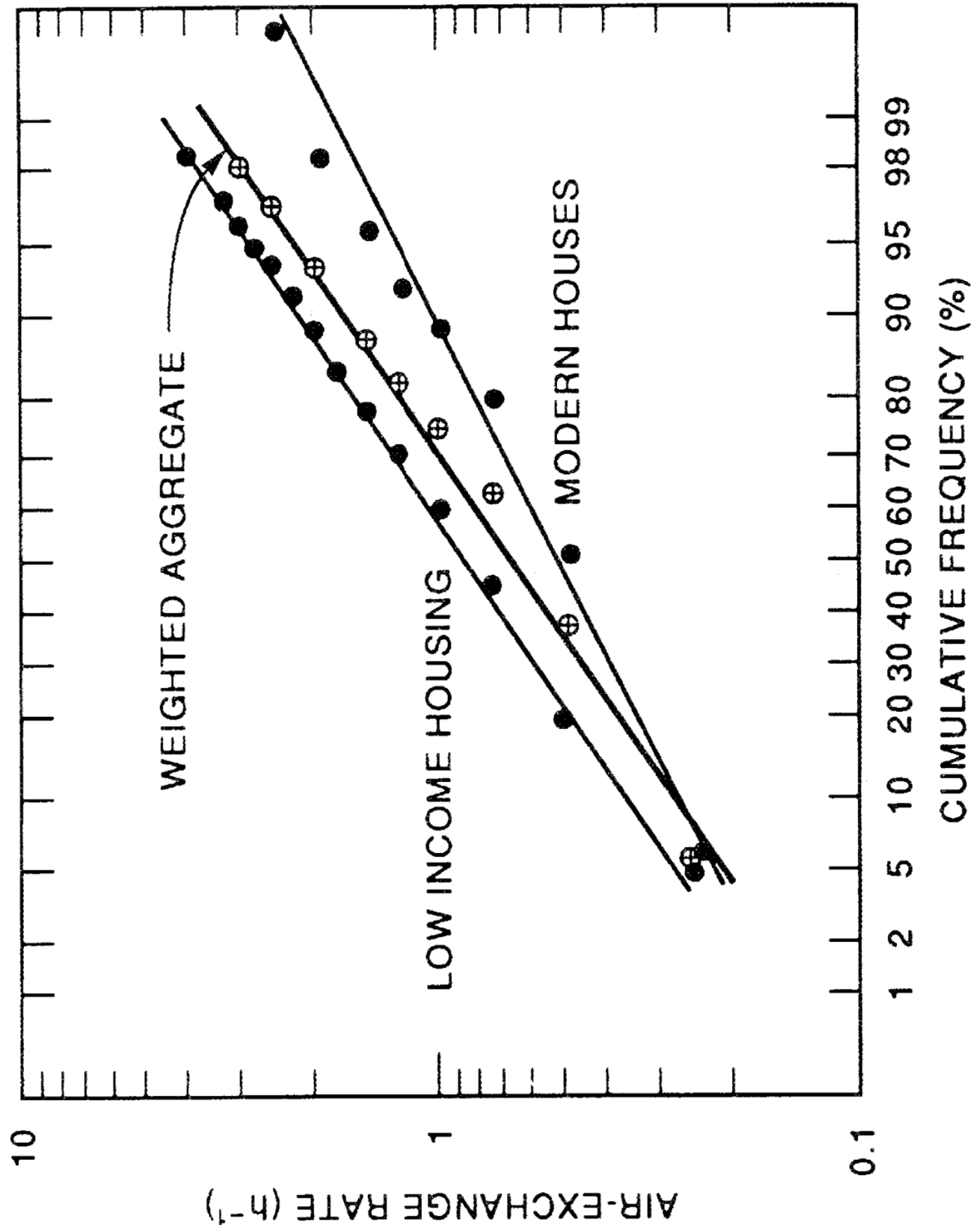


Fig. 3 Infiltration Rates of American Residences

Energy Division

Will Duct Tape and Plastic Really Work? Issues Related To Expedient Shelter-In-Place

John H. Sorensen
Barbara M. Vogt

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Chemical Stockpile Emergency Preparedness Program

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Although vapors, aerosols, and liquids cannot permeate glass windows or door panes, the amount of possible air filtration through the seals of the panes into frames could be significant, especially if frames are wood or other substance subject to expansion and contraction. To adequately seal the frames with tape could be difficult or impractical. For this reason, it has been suggested that pieces of heavy plastic sheeting larger than the window be used to cover the entire window, including the inside framing, and sealed in place with duct or other appropriate adhesive tape applied to the surrounding wall.

Another possible strategy would be to use shrink-wrap plastic often used in weatherization efforts in older houses. Shrink-wrap commonly comes in a 6 mil (0.006-in.) thickness and is adhered around the frame with double-faced tape and then heated with a hair dryer to achieve a tight fit. This would likely be more expensive than plastic sheeting and would require greater time and effort to install. Because double-faced tape has not been challenged with chemical warfare agents, another option is to use duct tape to adhere shrink-wrap to the walls. Currently, we do not recommend using shrink-wrap plastics because of the lack of information on its suitability and performance.

3. WHY WERE THESE MATERIALS CHOSEN?

Duct tape and plastic sheeting (polyethylene) were chosen because of their ability to effectively reduce infiltration and for their resistance to permeation from chemical warfare agents.

3.1 DUCT TAPE PERMEABILITY

Work on the effectiveness of expedient protection against chemical warfare agent simulants was conducted as part of a study on chemical protective clothing materials (Pal et al. 1993). Materials included a variety of chemical resistant fabrics and duct tape of 10 mil (0.01-in.) thickness. The materials were subject to liquid challenges by the simulants DIMP (a GB simulant), DMMP (a VX simulant), MAL (an organophosphorous pesticide), and DBS (a mustard simulant). The authors note that simulants should behave similarly to live agents in permeating the materials; they also note that this should be confirmed with the unitary agents. The study concluded that “duct tape exhibits reasonable resistance to permeation by the 4 simulants, although its resistance to DIMP (210 min) and DMMP (210 min) is not as good as its resistance to MAL (>24 h) and DBS (> 7 h). Due to its wide availability, duct tape appears to be a useful expedient material to provide at least a temporary seal against permeation by the agents” (Pal et al. 1993, p. 140).

3.2 PLASTIC SHEETING PERMEABILITY

Tests of the permeability of plastic sheeting (polyethylene) challenged with live chemical warfare agents were conducted at the Chemical Defense Establishment in Porton Down, England in 1970 (NATO 1983, p. 133). Agents tested included H and VX, but not GB. Four types of polyethylene of varying thickness were tested: 2.5, 4, 10 and 20 mil (0.0025, 0.004 in., 0.01 in., and 0.02 in.). The results of these tests are shown in Table 1.

Table 1: Permeability of plastic sheeting to liquid agent

Thickness	Breakthrough time (h)	
	VX	H
0.0025	3	0.3
0.004	7	0.4
0.01	30	2
0.02	48	7

Source: NATO 1983, p. 136.

The data shows that at thickness of 10 mil or greater, the plastic sheeting provided a good barrier for withstanding liquid agent challenges, offering better protection against VX than for H. Because the greatest challenge is from a liquid agent, the time to permeate the sheeting will be longer for aerosols and still longer for vapors, but the exact relationship is unknown due to a lack of test data.

NATO Civil Defense Committee 1983. *NATO Handbook on Standards and Rules for the Protection of the Civil Population Against Chemical Toxic Agents*, AC/23-D/680, 2nd rev.

Pal, T., G.Griffin, G. Miller, A. Watson, M. Doherty, and T. Vo-Dinh. 1993. “Permeation Measurements of Chemical Agent Simulants Through Protective Clothing Materials,” *J. Haz. Mat.* 33:123-141.

THE PROTECTION OF THE PUBLIC FROM AERIAL ATTACK

Being

A CRITICAL EXAMINATION OF THE
RECOMMENDATIONS PUT FORWARD BY THE
AIR RAID PRECAUTIONS DEPARTMENT OF
THE HOME OFFICE

by

THE CAMBRIDGE SCIENTISTS'
ANTI-WAR GROUP

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VICTOR GOLLANCZ LTD

1937

the time taken for the gas to leak out to half its original value was measured in four rooms—the basement of a shop, the dining-room of a semi-detached house, the sitting-room of a Council house and the bathroom of a modern villa. As stated above, the leakage half-times for these rooms were $2\frac{1}{2}$, $2\frac{1}{2}$, $3\frac{1}{2}$ and $9\frac{1}{4}$ hours respectively. The reason for the last room being so much better than all the others is that it has steel-frame windows which were sealed with plasticine, painted and tiled walls, and a concrete floor covered with cork tiles.

Note: even a 1 mile wide gas cloud passes in 6 min in 10 miles/hr wind ⁴¹ (hence good protection) This property of drifting with the wind is of some importance, for it means that the gas will not remain for long periods in any one place except on still days.

Now it may be objected that, although the “gas-proof” room is not hermetically sealed, it will nevertheless protect the occupants for the two or three hours necessary in case of an attack by a choking gas.

We assume that the gas blows away so quickly that every 10 minutes its concentration is halved. In Engelhard's experiments it took 10 minutes to liberate the gas from its cylinders, so that this assumption is reasonable. Then a person occupying a good "gas-proof" room, the leakage half-time of which (defined on p. 18) is 3 hours, would have breathed a lethal dose of phosgene in 2 hours.

Gas-schutz und Luftschutz, 4, 174, 1934

Complete lies: bombs are dropped, not cylinders. Engelhard's 1934 article in the Nazi controlled "Gas protection and air protection" journal is enemy propaganda; the Nazis kept the facts secret

INCENDIARY BOMBS

59

As, however, our experiments on the "gas-proof" room illustrate quite clearly that the ordinary dwelling-house is quite incapable of affording protection, it probably will not matter much what a civil population does under a gas and incendiary attack. Nor is it profitable to argue whether the gas or incendiary bomb is the more devastating, as it is necessary to contemplate an air attack in which both will be employed, with a sprinkling of high explosive bombs, which will considerably heighten the "psychological effect." This is the type of attack which people in large towns must expect if war breaks out; our task in this section is to discuss the proposals of the Home Office for dealing with incendiary bombs, remembering that whoever deals with them will require, almost certainly, simultaneous protection against gas. **PROVED WRONG!**

extreme lightness and cheapness of the incendiary bomb must be borne in mind. Mr. Noel-Baker cites the case of a single aeroplane carrying a load of less than a ton of bombs which succeeded in starting three hundred fires, and if we take a specimen raid of nine bombers, each carrying a thousand "kilo" bombs, nine thousand of these could be dropped on an area of two square miles. If very generous allowances are made for failures to function and for bombs falling on non-inflammable sites, in an urban area one fifth at least of these bombs should cause fires. This makes one thousand eight hundred fires. The danger of fire spreading over several blocks of buildings as in the San Francisco (1906) and Tokyo (1933) earthquakes, making the centre of the conflagration quite unapproachable by fire brigades is obvious.

To summarise this section, we reach the conclusion:

(a) That for individuals the cost of making buildings impenetrable to incendiary bombs is prohibitive.

(b) That, bearing in mind the probability of combined incendiary and gas attack, the civilian population will have considerable difficulty in extinguishing fires caused by incendiary bombs in private houses, unless assisted by experts. ← WRONG!

(c) That the fires caused by a raid such as is outlined above would very likely be impossible to deal with, even with the improved fire brigade organisation envisaged by the Home Office, because of the probable amalgamation of separate outbreaks into a vast conflagration.

FM 3-10

DEPARTMENT OF THE ARMY FIELD MANUAL

CHEMICAL AND BIOLOGICAL WEAPONS EMPLOYMENT



HEADQUARTERS, DEPARTMENT OF THE ARMY
FEBRUARY 1962

Line	1 Munition	2 Agent	3 Delivery system	4 User	5 Employment data			
					(a)		(b)	(c)
					Range (1) (Meters) (2)		Error	Fuze (Capability)
					Maximum	Minimum		
1	Shell, M2A1.....	HD	4.2-inch Mortar.....	US ARMY USMC	3,930.....	180.....	← Obtain from delivery unit or appropriate firing tables →	M8PD.....
2	Shell, M360.....	GB	105-mm Howitzer, M2A1, M2A2, M4, M4A2, M52.	US ARMY USMC	11,140.....	862.....		M508PD.....
3	Shell, M60.....	HD	105-mm Howitzer, M2A1, M2A2, M4, M4A2, M52.	US ARMY USMC	11,140.....			M51A5PD.....
4	Shell, M121.....	GB	155-mm Howitzer, M1, M1A1, M44.	US ARMY USMC	14,950.....			M508PD.....
5	Shell, M110.....	HD	155-mm Howitzer, M1, M1A1, M44.	US ARMY USMC	14,950.....			M51A5PD.....
6	Shell, T__ (M121).....	VX	155-mm Howitzer, M1, M1A1, M44.	US ARMY USMC	14,950.....			T76E6VT ¹
7	Shell, M122.....	GB	155-mm Gun, M2, M53.....	USMC.....	23,500.....			M508PD.....
8	Shell, M104.....	HD	155-mm Gun, M2, M53.....	USMC.....				M51A5PD.....
9	Shell, Gas, 175-mm.....	GB	M107 Gun (SP).....	US ARMY	31,500.....	180.....		
10	Shell, Gas, 175-mm.....	VX	M107 Gun (SP).....	US ARMY	31,500.....	180.....		VT-M514A1.....
11	Shell, T174.....	GB	8-inch Howitzer, M2, M2A1, M55.	US ARMY USMC	16,930.....			M51A5PD.....
12	Shell, T174.....	VX	8-inch Howitzer, M2, M2A1, M55.	US ARMY USMC.	16,930.....		← Obtain from delivery unit →	T2061 VT.....
13	Rocket, M55, 115-mm (BOLT)...	GB	Launcher, M91.....	US ARMY USMC.	10,970.....	2,740.....		M417PD.....
14	Rocket, M55, 115-mm (BOLT)...	VX	Launcher, M91.....	US ARMY USMC.	10,970.....	2,740.....		T2061 VT.....
15	Warhead, M79, 762-mm (HON- EST JOHN).	GB	Rocket, M31A1C Launcher, M386.	US ARMY USMC.	24,960.....	8,500.....		T2075 Mech Time.....
16	Warhead, E19R2, 762-mm (HONEST JOHN).	GB	Rocket, XM50 Launcher, M386.	US ARMY USMC.	33,830.....	8,500.....		T2075 Mech Time.....
17	Warhead, E19R2, 762-mm (HONEST JOHN).	VX	Rocket, XM50 Launcher, M386.	US ARMY USMC.	33,830.....	8,500.....		T2075 Mech Time.....
18	Warhead, E20, 318-mm (LIT- TLE JOHN).	GB	Rocket, XM51 Launcher, XM80.	US ARMY USMC.	18,290.....	3,200 ¹		T2075 Mech Time.....
19	Warhead, E21, (SERGEANT)...	GB	Rocket, Launcher.....	US ARMY	139 km.....	50 km.....	304m...	Preset Radar.....
20	Warhead, E21, (SERGEANT)...	VX	Rocket, Launcher.....	US ARMY	139 km.....	50 km.....	304m...	Preset Radar.....
21	Bomb, M34A1, 1000-lb, Cluster...	GB	Fighter, Bomber.....	USAF.....	Range of Aircraft.		← Obtain from delivery unit →	M152E3 Mech Time...
22	Bomb, MC-1, 750-lb.....	GB	Fighter, Bomber.....	USAF.....	Range of Aircraft.			M905BD.....
23	Projectile, 5"/38, MK53, MOD O.	GB	5-inch Gun.....	US NAVY	16,450.....			MK29MOD3PD.....
24	Projectile, 5"/54, MK54, MOD O.	GB	5-inch Gun.....	US NAVY	19,200.....			MK30MOD3PD.....
25	Warhead, Rocket, 5" MK40, MOD O.	GB	Launcher, MK 105 Rocket, M40, MOD O.	US NAVY	4,200.....			MK30MOD3PD.....
26	Warhead, Rocket, 5", MK40, MOD O.	HD	Launcher, MK 105 Rocket, M40, MOD O.	US NAVY	4,200.....			MK30MOD3PD.....
27	Bomb, MK94, MOD O.....	GB	Fighter, Bomber.....	US NAVY	Range of Aircraft.			AN-M103A1ND M195 BD (IM- PACT).
28	Bomb, M70A1.....	HD	Fighter, Bomber.....	US NAVY	Range of Aircraft.			AN-M158ND (IM- PACT).
29	Mine, Land, Chemical, M23.....	VX	N/A.....	US ARMY	N/A.....	N/A.....	N/A	
30	Mine, Land, Chemical, One- Gallon.	HD	N/A.....	US ARMY	N/A.....	N/A.....	N/A	

See notes at end of figure.

Figure 5. Chemical munitions and delivery systems.

5 Employment data—Continued						6 Functioning and physical characteristics of CML munitions				
(d)		(e)	(f)	(g)	(h)	(a)	(b)	(c)	(d)	(e)
Time for delivery		Organization	Rate of fire per weapon	Height of burst	Diameter (meters) of impact area (single rd) ²	Weight of munition (kg)	Weight of agent (kg)	Effective weight of agent (kg) ³	Function- ing effi- ciency of munition (percent)	Agent dissemi- nation efficiency
(1)	(2) Target of opportunity									
Preplanned		6 Mort/Plt.....	30 Rds/2 min.....	GND.....	16.....	10.8	2.72		99	
	1-3 min.....	8 Mort/Btry.....	105 Rds/15 min.....							
		6 How/Btry.....	6 Rds/½ min.....	GND.....	27.....	16.1	.739		99	
	1-3 min.....	6 How/Btry.....	18 Rds/4 min.....							
			6 Rds/½ min.....	GND.....	11.....	15.2	1.22		99	
	1-5 min.....	6 How/Btry.....	18 Rds/4 min.....							
			3 Rds/½ min.....	GND.....	49.....	45.9	2.95		99	
	1-5 min.....	6 How/Btry.....	12 Rds/4 min.....							
			3 Rds/½ min.....	GND.....	20.....	42.0	4.4		99	
	1-5 min.....	6 How/Btry.....	12 Rds/4 min.....							
			3 Rds/½ min.....	20m ¹		45.9	2.95		99	
	1-5 min.....	4 Gun/Btry.....	12 Rds/4 min.....							
			2 Rds/½ min.....	GND.....	49.....	45.9	2.95		99	
	1-5 min.....	4 Gun/Btry.....	8 Rds/4 min.....							
			2 Rds/½ min.....	GND.....	22.....	43.0	5.31			
			8 Rds/4 min.....							
		4 Gun/Btry.....		GND.....		66.8	6.68			
		4 Gun/Btry.....		GND.....		66.8	6.04			
	½-6 hr.....	4 How/Btry.....	6 Rds/4 min.....	GND.....	76.....	97.0	7.12		99	
			10 Rds/10 min.....							
	½-6 hr.....	4 How/Btry.....	6 Rds/4 min.....	20m ¹		97.0	7.12		99	
			10 Rds/10 min.....							
	30 min.....	36 Lehr/Bn.....	45 Rkt/Lehr/15 sec.....	GND.....	46.....	26.4	4.80		99	
	30 min.....	36 Lehr/Bn.....	45 Rkt/Lehr/15 sec.....	20m ¹		26.2	4.54		99	
	15 min.....	2 Lehr/Bn.....	2/Hr.....	Variable.....	Variable.....	737	177.5	104.8	95	62 per- cent.
	15 min.....	2 Lehr/Btry.....	2/Hr.....	Variable.....	Variable.....	568	210	171	95	86 per- cent.
	15 min.....	2 Lehr/Btry.....	2/Hr.....	Variable.....	Variable.....	568	210			
	15 min.....	4 Lehr/Btry.....	2/Hr.....	Variable.....	Variable.....	119	30			
15 min.....	120 min.....	4 Lehr/Bn.....	2/Day.....	Intervals of 1,524m.....	Variable.....	744	190			
15 min.....	120 min.....	4 Lehr/Bn.....	2/Day.....	Intervals of 1,524m.....	Variable.....	744	190			
	15 min + flight time.....		2-6/Ftr.....	Variable.....	170.....	513	89.6		90	
	15 min + flight time.....		4-18/Bmbr.....							
			2-6/Ftr.....	GND.....	127.....	322	99.9			
			4-27/Bmbr.....							
				GND.....	35.....	25.1	1.47			
				GND.....	40.....	29.1	2.02			
			48 Rkt/Lehr/ 1 min.....	GND.....	49.....	22.9	2.18			
			48 Rkt/Lehr/ 1 min.....	GND.....						
				GND.....	90.....	222	49.8			
				GND.....	29.....	58.0	272			
						10.50	5.23			
						5.45	4.50			

¹ Estimated.

² Instantaneous agent area coverage 30 seconds after detonation.

³ Values are the product of values given in columns 6(b), 6(d), and 6(e). Since values for 6(e) are not available, values for 6(c) cannot be computed at this time.

Figure 5.—Continued

Agent—GB.

Wind speed—5 knots (approx 9 km/hr).

Temperature gradient—inversion.

Temperature—60° F. (15.5° C.).

Terrain—open, level, scattered vegetation.

Precipitation—none.

Time limitations on the delivery of agent on target—4 minutes or less.

Casualty level desired—20 percent.

Find: Whether or not the mission can be fired with a 105-mm howitzer battery.

Solution:

- (a) Using figure 11, convert 20 percent casualties among protected personnel to the corresponding casualty level among unprotected personnel. This is 80 percent.
- (b) Using the “GB (over 30-sec attack)” column of figure 12, determine the total effects components to be 3.21 as follows:

Inversion.....	1. 09
Wind speed, 9 km/hr.....	1. 00
Temperature, 60° F. (15.5° C.).....	. 12
Open terrain.....	. 30
No precipitation.....	. 70
	3. 21

- (c) Using figure 13, place a hairline between 80 percent on the percent casualties scale and 12 hectares on the target area scale. On the point of intersection on the reference line, pivot the hairline until it intersects 3.21 on the effects components scale. On the munitions expenditure scale, read 12 as the number of 155-mm equivalents required.
- (d) To find the number of 105-mm rounds required to fire the mission, multiply 12 by a factor of four (obtain this factor from figure 8); the product is 48 rounds.
- (e) From figure 9, it is evident that one battery of six howitzers can easily fire the mission if no shift of fires is re-

quired. Since the target is twice as large as the dispersion pattern of a 105-mm battery (par. 31c(3)(c) and 41d), a shift of fires should be made. Figure 9 gives a time of 30 seconds for shifting of fires. On this basis the battery could fire twenty-four rounds on half the target in a little less than 30 seconds, take 30 seconds to shift fires, and have ample time to deliver the remaining twenty-four rounds on the other half of the target. The firing should be completed in less than 2 minutes.

Munition	Munition expressed in terms of 155-mm chemical equivalents		
	GB	VX	HD
155-mm Shell.....	1	1	1
105-mm Shell.....	0. 25		0. 28
8-inch Shell.....	2. 40	2. 17	
4.2-inch Mortar Shell.....			. 62
175-mm Shell.....	2. 1	2. 1	
M55 Rocket.....	1. 6	1. 6	
M79 Warhead—HONEST JOHN.....	60		
E19R2 Warhead—HON-EST JOHN.....	71	71	
LITTLE JOHN.....	10	10	
SERGEANT.....	65	65	
M34A1 1000-lb Cluster.....	30		
MC1 750-lb Bomb.....	35		
5''/38 Gas Projectile (Navy).....	. 50		
5''/54 Gas Projectile (Navy).....	. 68		
5'' Gas Rocket (Navy).....	. 74		
500-lb Gas Bomb.....	17		
115-lb Gas Bomb (Navy).....			6. 2

Figure 7. Munitions expressed in terms of 155-mm chemical equivalents. (The figures given are an estimate of the number of 155-mm howitzer rounds required to give the same effect as one round of the specified munition. Dissemination efficiency has not been considered.)

Munition	Conversion factor		
	GB	VX	HD
155-mm Shell.....	1	1	1
105-mm Shell.....	4		3. 6
8-inch Shell.....	0. 41	0. 45	
4.2-inch Mortar Shell.....			1. 61
175-mm Shell.....	. 48	. 48	
M55 Rocket.....	. 61	. 61	
M79 Warhead—HONEST JOHN.....	. 017		
E19R2 Warhead—HON-EST JOHN.....	. 014	. 014	
LITTLE JOHN.....	. 098	. 098	
SERGEANT.....	. 016	. 016	
M34A1 1000-lb Cluster.....	. 033		
MC1 750-lb Bomb.....	. 029		
5''/38 Gas Projectile (Navy).....	2. 00		
5''/54 Gas Projectile (Navy).....	1. 46		
5'' Gas Rocket (Navy).....	1. 35		
500-lb Gas Bomb.....	. 059		
115-lb Gas Bomb (Navy).....			. 164

Figure 8. Conversion factors for converting 155-mm munitions to other munitions.

Weapon	Maximum rate (rounds)	Rates of fire for chemical fire missions without shifting or relaying of the piece (rounds)					Estimated time to shift fires
	30 sec	1 min	2 min	4 min	10 min	15 min	
105-mm Howitzer.....	6	10	14	18	40	60	30 sec
155-mm Howitzer.....	3	5	7	12	30	40	30 sec
155-mm Gun.....	2	4	6	8	12	18	60 sec
8-inch Howitzer.....	1	2	3	6	10	15	60 sec
4.2-inch Mortar.....	10	16	30 (max)	50	80	105	30 sec
M91 Launcher (M55 Rocket).....	45 (15 sec)	Launcher must relocate after firing each ripple.					

Figure 9. Approximate rates of fire for division cannon artillery, mortars, and multiple rockets firing chemical rounds. (Rates of fire for other weapons are given in figure 5.)

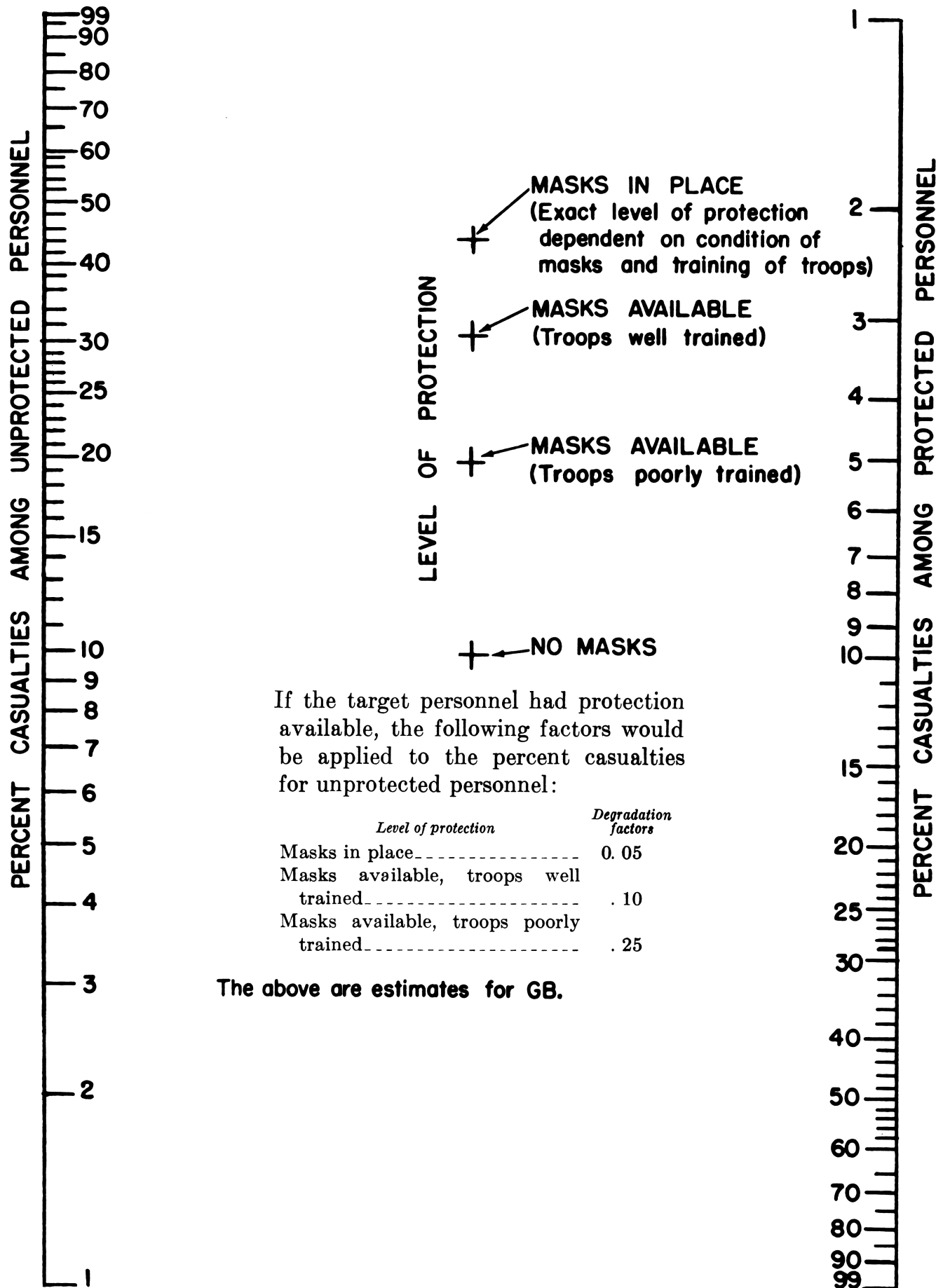


Figure 11. Nomogram for conversion of percent GB casualties for protection of personnel in the target area.

Meteorological and terrain conditions	Effects components			
	GB ² (surprise attack)	GB (over 30-sec attack)	VX	HD
1. <i>Temperature Gradient</i>				
Inversion.....	0. 67	1. 09	1. 89	0. 69
Neutral.....	. 57	. 69	1. 89	. 54
Lapse.....	. 30	. 09	1. 89	. 32
2. <i>Wind Speed (km/hr)</i>				
0 to 5.....	. 20	1. 30	0	. 87
6 to 10.....	. 50	1. 00	0	. 70
11 to 16.....	. 70	. 70	0	. 60
17 to 26.....	. 55	. 30	0	. 48
27 to 52.....	. 30	0	0	0
3. <i>Temperature (° F.)</i>				
a. 0 to 39 (—18° to 4° C.).....	0	0	0	-----
40 to 79 (5° to 26° C.).....	. 12	. 12	0	-----
80 and up (27° C. and up).....	. 23	. 23	0	-----
b. 30 to 49 (—1° to 9° C.).....			0	0
50 to 69 (10° to 21° C.).....			0	. 70
70 and up (22° C. and up).....			0	1. 00
4. <i>Terrain</i>				
Open, level, scattered vegetation.....	. 30	. 30	0	. 30
Rugged, mountainous.....	0	¹ 0	¹ 0	¹ 0
5. <i>Precipitation</i>				
None.....	. 70	. 70	. 70	0
Moderate rain.....	0	¹ 0	¹ 0	¹ 0

¹ Estimated.

² Tentative figures not yet verified.

Figure 12. Effects components.

Note: paragraph 105 on page 82 states that the "safe entry times" after bio attacks are:

NU (Venezuelan equine encephalitis virus),
AB (bovine brucellosis), and

UL (tularemia): 2 hrs sun or 8 hrs cloudy

OU (Q fever): 2 hrs sun or 18 hrs cloudy

Cloudy conditions also apply to nighttime

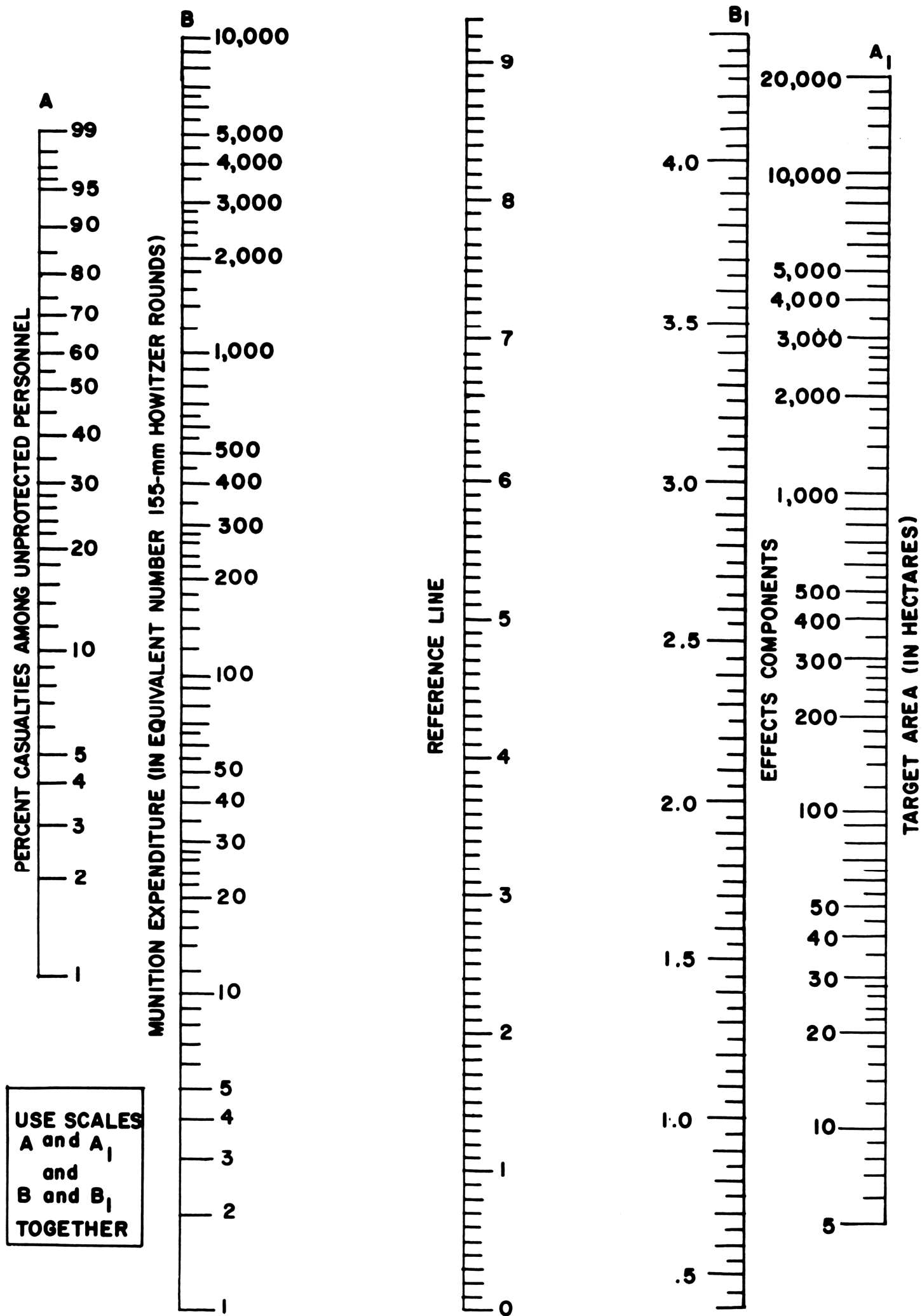
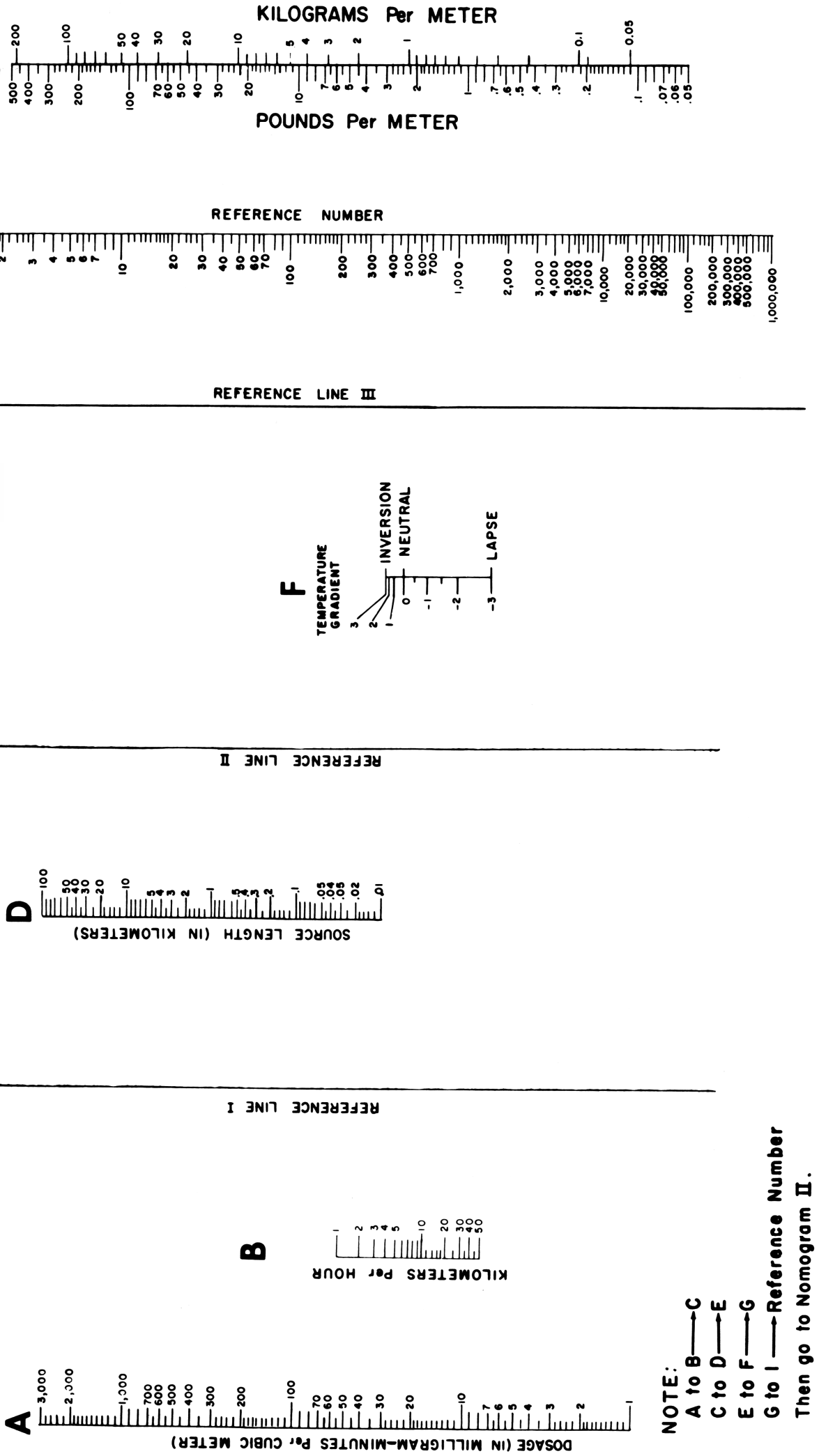


Figure 13. Target area, casualty level, munitions requirement nomogram.



NOTE:
A to B → C
C to D → E
E to F → G
G to I → Reference Number
Then go to Nomogram II.

Figure 14. Downwind distance nomogram I.

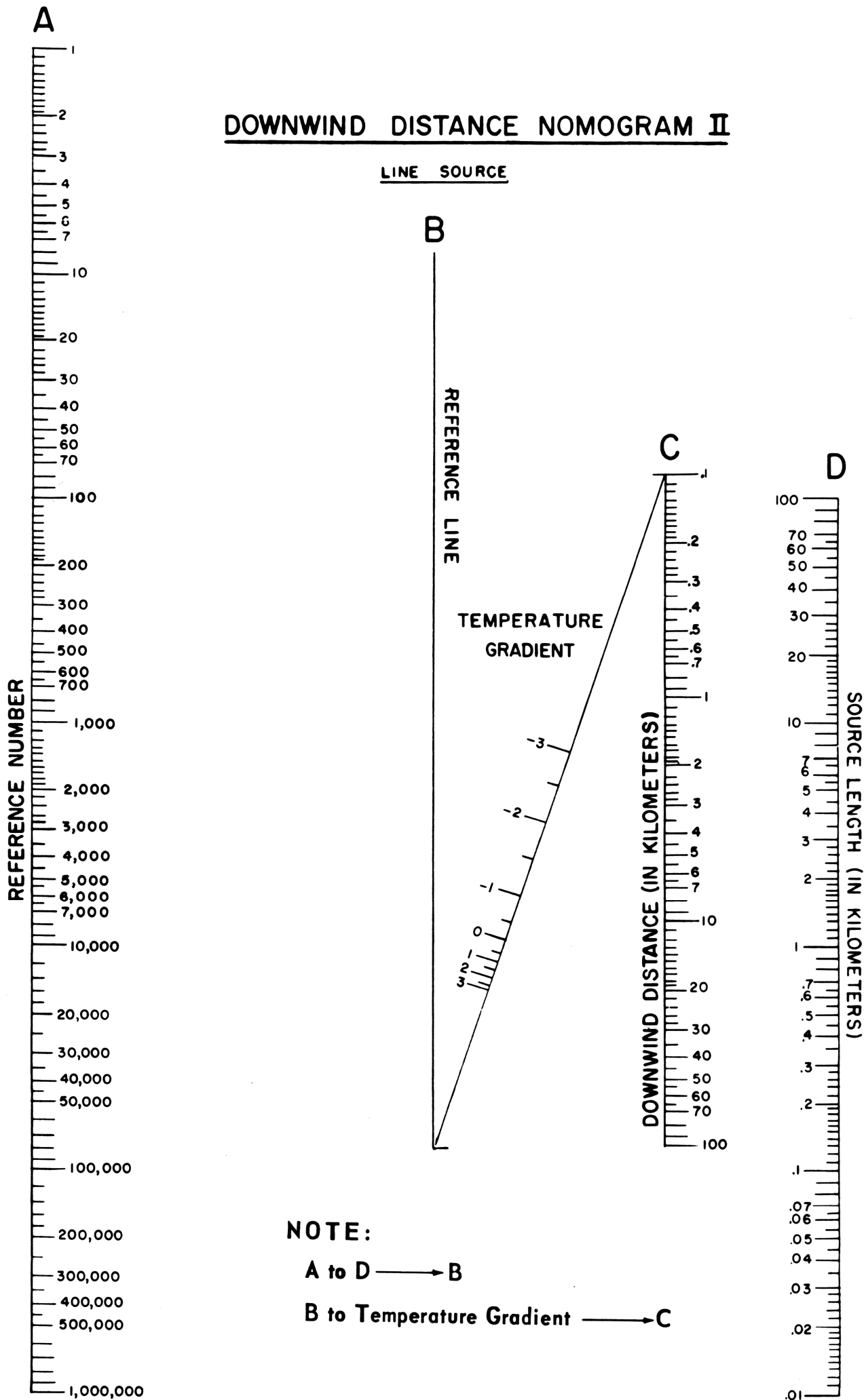


Figure 15. Downwind distance nomogram II.

REFERENCE BOOK

CHEMICAL AND BIOLOGICAL WEAPON EMPLOYMENT



U.S. ARMY COMMAND AND GENERAL STAFF COLLEGE
Fort Leavenworth, Kansas
1 May 1968

This reference book supersedes RB 3-1, 1 May 1967

CHAPTER 2

TOXIC CHEMICAL AGENTS

1. Characteristics and Effects

a. General. The following antipersonnel chemical agents are used for College instruction in chemical weapon employment: nerve agents GB and VX; blister agent HD (mustard); and incapacitating agent BZ. Actual or assumed characteristics of these agents are described in the following paragraphs for instructional purposes only and are summarized in figure 1.

b. Nerve Agent GB. GB is a quick acting, nonpersistent lethal agent that produces casualties primarily by inhalation.

(1) Inhalation effects. Inhaled GB vapor can produce casualties within minutes. As an example, 50 percent of a group of unprotected troops engaged in mild activity, breathing at the rate of about 15 liters per minute, and exposed to 70 milligrams of GB per cubic meter of air for 1 minute will probably die if they do not receive medical treatment in time. This is the median lethal dosage (50) and is expressed as 70 mg-min/m³. For troops engaged in activities that increase their breathing rate, the median lethal dosage can be as low as 20 mg-min/m³. The median incapacitating dosage of GB vapor by inhalation is about 35 mg-min/m³ for troops engaged in mild activity. Incapacitating effects consist of nausea, vomiting, diarrhea, and difficulty with vision, followed by muscular twitching, convulsions, and partial paralysis. Dosages of GB less than the median incapacitating dosage cause general lowering of efficiency, slower reactions, mental confusion, irritability, severe headache, lack of coordination, and dimness of vision due to pinpointing of the eye pupils.

(2) Percutaneous effects. Percutaneous effects refer to those effects produced by the absorption of the agent through the skin. GB vapor absorbed through the skin can produce incapacitating effects. Sufficient GB liquid ab-

sorbed through the skin can produce incapacitation or death. The effectiveness of the liquid or vapor depends on the amount absorbed by the body. Absorption varies with the original amount of agent contamination, the skin area exposed and the exposure time, the amount and kind of clothing worn, and the rapidity in removing the contamination and/or contaminated clothing and in decontaminating affected areas of the skin.

(3) Major considerations in the employment of nerve agent GB. The employment of GB is based primarily on achieving casualties by inhalation of the nonpersistent vapor (or aerosol) of the agent. Major considerations in the employment of this agent are:

(a) Time to incapacitate. The onset of incapacitation resulting from inhalation of casualty-producing doses is rapid, the average time being approximately 3 minutes. To allow for the time required for the agent cloud to reach the individual, 10 minutes is used as the mean time to achieve incapacitation. Nonlethal casualties from GB will be incapacitated for 1 to 5 days.

(b) Persistency. Persistency is defined as the length of time an agent remains effective in the target area after dissemination. Nerve agent GB is considered nonpersistent. GB clouds capable of producing significant casualties will dissipate within minutes after dissemination. Some liquid GB will remain in chemical shell or bomb craters for periods of time varying from hours to days, depending on the weather conditions and type of munition. Because of this continuing but not readily discernible threat, GB can also be highly effective in harassing roles by causing exposure to low concentrations of the vapor. Rounds fired sporadically may compel the enemy to wear protective masks and clothing for prolonged periods, thereby impairing his effectiveness as a result of fatigue, heat stress, discomfort, and decrease in perception.

(c) Level of protection. The weapon system requirements for positive neutralization of masked personnel by GB are too great to be supported except for important point or small area targets. A major factor affecting casualties resulting from GB attacks of personnel equipped with masks but unmasked at the time of attack is the time required for enemy troops to mask after first detecting a chemical attack. Therefore, surprise dosage attack is used to establish a dosage sufficient to produce the desired casualties before troops can mask. Casualty levels for surprise dosage attack that are tabulated in the weapon system effects tables (app A) are based on an assumed enemy masking time of 30 seconds. (Refer to FM 3-10 series manuals for operational data for masking times less than 30 seconds.) A total dosage attack is used to build up the dosage over an extended period of time and is normally employed against troops who have no protective masks available. Dosages built up before troops can mask inside foxholes, bunkers, tanks, buildings, and similar structures will generally be less than dosages attained during the same period of time in the open, thereby reducing the effects on occupants from surprise dosage attacks. Total dosage effects are essentially the same inside or outside.

c. Nerve Agent VX. VX is a slow-acting, lethal, persistent agent that produces casualties primarily by absorption of droplets through the skin.

(1) Effects. VX acts on the nerve systems of man; interferes with breathing; and causes convulsions, paralysis, and death.

(2) Major considerations in the employment of nerve agent VX.

(a) General. Agent VX disseminated in droplet (liquid) form provides maximum duration of effectiveness as a lethal casualty threat. VX will remain effective in the target area for several days to a week depending on weather conditions. Because of its low volatility,

there is no significant vapor hazard downwind of a contaminated area. Except when disseminated by aircraft spray tanks, meteorological conditions have little effect on the employment of VX, although strong winds may influence the distribution of the agent and heavy rainfall may wash it away or dissipate it.

(b) Employment to cause casualties. Agent VX is appropriate for direct attack of area targets containing masked personnel in the open or in foxholes without overhead protection, for causing severe harassment by the continuing casualty threat of agent droplets on the ground or on equipment, and for creating obstacles to traversing or occupying areas. Casualties produced by agent VX are delayed, occurring at times greater than 1 hour after exposure. Although this agent can be used relatively close to friendly forces, it should not be used on positions that are likely to be occupied by friendly forces within a few days. Because of this continuing hazard, areas in which agent VX has been used should be recorded in a manner similar to minefields or fallout areas so that necessary precautions can be taken.

d. Blister Agent HD. HD, sometimes referred to as mustard, is a persistent slow-acting agent that produces casualties through both its vapor and liquid effects.

(1) Vapor effects.

(a) The initial disabling effect of HD vapor on unmasked troops will be injuries to the eyes. Temporary blindness can be caused by vapor dosages that are insufficient to produce respiratory damage or skin burns. However, skin burns account for most injuries to masked troops. The vapor dosages and the time required to produce casualties (4 to 24 hours) vary with the atmospheric conditions of temperature and humidity and with the amount of moisture on the skin. Depending on their severity, skin burns can limit or entirely prevent movement of the limbs or of the entire body.

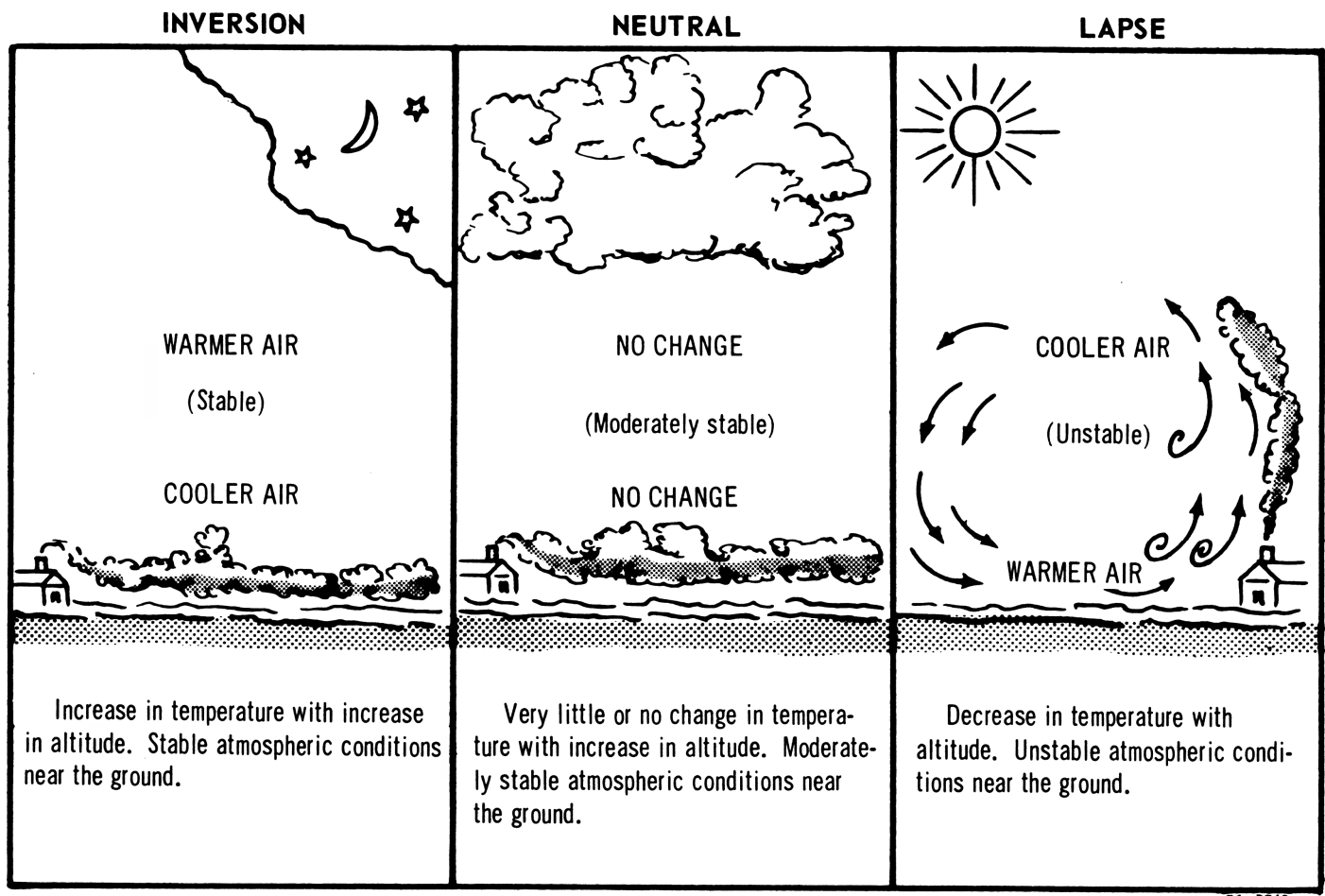


Figure 2. Temperature gradients.

Surprise dosage GB attacks are influenced only slightly by the temperature gradient except when made with the spray tank. Downwind vapor hazards to both enemy and friendly forces will be most significant during inversion and neutral conditions. Employment of VX is not affected by the temperature gradient.

temperature, 9 kmph is used as wind-speed, and the temperature gradient is approximated from figure 3.

d. Windspeed and Direction.

(1) Air moving over the earth's surface sets up eddies, or mechanical turbulences, that act to dissipate a chemical cloud. A condition of calm will limit the merging of the individual gas clouds. Both of these conditions may reduce the effectiveness of a chemical agent attack. High winds increase the rate of evaporation of HD and dissipate chemical clouds more rapidly than low winds. Moderate winds are desirable for chemical employment. Large-area non-persistent chemical attacks are most effective in winds not exceeding 28 kmph. Small-area nonpersistent chemical attacks with rockets or shell are most effective in winds not exceeding 9 kmph. However, if the concentration of chemical agent can be established quickly, the effects of high windspeed can be partially offset.

Temperature gradients	Time
1. Inversion	From sunset to sunrise.
2. Neutral	2 hours before sunset to sunset, sunrise to 2 hours after sunrise, or any time windspeed is 15 kmph or greater.
3. Lapse	2 hours after sunrise to 2 hours before sunset.

Figure 3. Estimated times that temperature gradients will prevail. (Use when meteorological data are not available.)

(3) When actual or predicted meteorological conditions are not available for a target analysis, 70° F is used for

CHAPTER 4

EMPLOYMENT OF BIOLOGICAL AGENTS

1. General

a. Antipersonnel biological agents are micro-organisms that produce disease in man. These agents can be used to incapacitate or kill enemy troops through disease. They may cause large numbers of casualties over vast areas and could require the enemy to use many personnel and great quantities of supplies and equipment to treat and handle the casualties. Many square kilometers can be effectively covered from a single aircraft or missile. The search capability of biological agent clouds and the relatively small dose required to cause infection among troops give biological munitions the capability of covering large areas where targets are not precisely located.

b. A biological attack can occur without warning since biological agents can be disseminated by relatively unobtrusive weapon systems functioning at a considerable distance from the target area and relying upon air movement to carry the agent to the target.

c. Biological agents do not produce effects immediately. An incubation period is required from the time the agent enters the body until it produces disease. Some agents produce the desired casualty levels within a few days, whereas others may require more time to produce useful casualty levels. A variety of effects may be produced, varying from incapacitation with few deaths to a high percentage of deaths, depending on the type of agent.

2. Methods of Dissemination

a. The basic method of disseminating antipersonnel biological agents is the generation of aerosols by explosive bomblets and spray devices. Because exposure to sunlight increases the rate at which most biological agent aerosols die and thereby reduces their area coverage, night is the preferable time for most biological attacks. However, if troop safety is a problem, an attack may be made near sunrise to reduce the

distance downwind that a hazard to friendly forces will extend. Conversely, to extend the downwind cloud travel and the area coverage from spray attack, a biological agent may be employed soon after sundown.

b. Missile-delivered Biological Munitions. Missile-delivered biological munitions are used for attack of large-area targets. A typical biological missile system consists of the following components:

(1) A missile vehicle and its launching equipment.

(2) A warhead that can be opened at a predetermined height to release biological bomblets over the target area. The warhead is shipped separately for assembly to a missile at the launching site.

(3) A warhead shipping container equipped with a heating-cooling element and a temperature control unit.

(4) Biological bomblets consisting of an agent container and a central burster that functions on impact. The bomblets have vanes that cause them to rotate in flight, thereby achieving lateral dispersion during their free fall and resulting in random distribution as a circular pattern.

c. Aircraft Spray Tank. Biological agents released from an aircraft spray tank cover a large area downwind of the line of release. A typical spray tank consists of the following components:

(1) An agent reservoir section that is shipped separately in an insulated shipping and storage container equipped with a heating-cooling element and a temperature control unit.

(2) A discharge nozzle assembly that can be mechanically adjusted to vary the agent flow rate.

Table 1. Chemical Weapons Data

1	2	3	4	5	6	7	8	9	10	11	12	13			
Delivery system	Range (meters)		Agent	Munition	No of weapons per delivery unit	Weapon rate of fire	RT max (meters) ^{1 2}					Reference (table)			
							Fire unit	Total dosage		Surprise dosage					
	Casualty threat	Casualty threat						Casualty threat	Casualty threat						
	Min	Max					10%	30%	10%	30%					
4.2-in mortar	180	4,500	HD	Cartridge, M2A1	4/Plat	50 rd/3 min 105 rd/15 min						18 19			
105-mm howitzer		11,100	GB	Cartridge, M360	6/btry	5 rd/30 sec 30 rd/3 min 66 rd/15 min	1 btry ³	200	100	100	50	2			
				1 bn ³			300	300	200	100	3				
			HD	Cartridge, M60								18 19			
155-mm howitzer		14,600	GB	Projectile, M121	6/btry	2 rd/30 sec 12 rd/3 min 24 rd/15 min	1 btry ³	300	200	100	0	4			
				1 bn ³			500	400	300	100	5				
			HD	Projectile, M110							18 19				
			VX ⁴	Projectile, M121			1 btry ³	400	200	NA	NA	13			
				1 bn ³			500	400							
8-in howitzer		16,800	GB	Projectile, M426	4/btry	1 rd/30 sec 4 rd/3 min 10 rd/15 min	1 btry ³	300	200	200	0	6			
							1 bn ³	500	400	300	100	7			
			VX ⁴				1 btry ³	400	200	NA	NA	14			
							1 bn ³	500	400						
115-mm multiple rocket launcher, M91	2,740	10,600	GB ⁴	Rocket, M55 (THE BOLT)		45 rkt/lchr/15 sec	1 lchr	1,000	750	500	200	8			
							3 lchr	1,000	1,000	750	400				
							6 lchr	1,000	1,000	1,000	750				
							9 lchr	1,000	1,000	1,000	1,000				
			VX ⁴				1 lchr	300	0	NA	NA	15			
							3 lchr	750	300						
							6 lchr	1,000	400						
							9 lchr	1,000	750						
762-mm rocket, Honest John	8,500	38,000	GB ⁴	Warhead, M190 (M139 bomblets)	2/btry	2 rkt/lchr/hr	1 lchr	600	600	600	400	9			
							2 lchr	600	600	600	400				
Sergeant missile	46,000	139,000	GB ⁴	Warhead, M212 (M139 bomblets)	2/bn	2 msl/lchr/hr	1 msl	600	400	600	200	10			
							2 msl	600	600	600	400				
Aircraft	Dependent on type aircraft		GB ⁴	Bomb, MC-1, 750-lb	Dependent on type aircraft		1 bomb	50				11			
							6 bombs	300	200	300	50				
							12 bombs	500	300	400	200				
							24 bombs	500	300	500	300				
			GB ⁴	Spray tank, 100-gal			1 spray tank	RT max = 750 meters (one-half effective spray release line length)				12			
							2 spray tanks								
			VX ⁴				1 spray tank	RT max = 500 meters (one-half effective spray release line length)				16			
			BZ ⁴	Bomb, 150-lb							17				
	Bomb, 700-lb														

¹RT max is largest target radius for which indicated casualty threat is tabulated for appropriate fire unit. Division of target into subtargets NOT considered.

²All windspeeds, temperature gradients, and protection categories considered.

³RT max computed for maximum number of volleys for which data are tabulated.

⁴Weapon system capabilities derived from tables composed of hypothetical data for INSTRUCTIONAL PURPOSES ONLY at the U. S. Army Command and General Staff College. For actual data, refer to FM 3-10.

105-MM HOW/GB BTRY FIRE

Table 2. Estimated Fractional Casualty Threat From 105-mm Howitzer,
GB Projectile, Battery Fire^{1 2}

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Target radius— radius of effect (meters)	Range to target (km)	No of volleys	Windspeed ³											
			4 kmph				9 kmph				28 kmph			
			Surprise ⁴	Total dose ⁵			Surprise ⁴	Total dose ⁵			Surprise ⁴	Total dose ⁵		
				I	N	L		I	N	L		I	N	L
50	<7.5	1	.10	.25	.20	.15	.10	.15	.10	.10				
		2	.20	.45	.40	.30	.15	.30	.25	.20		.10	.05	.05
		3	.30	.60	.60	.35	.30	.50	.45	.30	.10	.20	.15	.10
		4	.30	.75	.70	.45	.30	.55	.45	.35	.10	.25	.20	.10
		5	.35	.90	.85	.55	.35	.60	.50	.40	.15	.30	.25	.15
	>7.5	1	.05	.15	.15	.10	.05	.10	.05	.05				
		2	.15	.30	.25	.15	.10	.20	.15	.10		.05	.05	
		3	.15	.30	.30	.25	.10	.20	.20	.15		.10	.05	.05
		4	.20	.40	.35	.25	.15	.30	.30	.15	.05	.15	.15	.05
		5	.25	.45	.45	.30	.25	.40	.35	.25	.10	.20	.20	.10
100	<7.5	1	.05	.15	.15	.10	.05	.10	.05	.05				
		2	.10	.30	.30	.15	.10	.20	.15	.10				
		3	.15	.40	.35	.20	.15	.25	.25	.15	.05	.10	.05	
		4	.15	.40	.35	.30	.15	.30	.30	.15	.05	.10	.10	.05
		5	.20	.45	.40	.35	.20	.35	.35	.20	.10	.15	.15	.10
	≥7.5	1	.05	.10	.10	.05		.05	.05					
		2	.10	.20	.20	.10	.05	.15	.10	.05				
		3	.10	.25	.25	.15	.10	.15	.15	.10		.05	.05	
		4	.10	.30	.25	.20	.10	.25	.20	.15		.10	.05	
		5	.15	.35	.30	.25	.15	.30	.25	.15	.05	.15	.10	.05
200	Any	1		.05	.05									
		2		.10	.10	.05		.05	.05					
		3	.05	.15	.15	.05		.10	.05					
		4	.05	.15	.15	.10		.10	.10					
		5	.05	.20	.20	.10	.05	.15	.10	.05				

¹ Blank spaces indicate fractional casualties are below 0.05.

² If the target is predominately wooded, use a windspeed of 4 kmph and neutral temperature gradient for total dose attack; use a windspeed of 4 kmph for surprise attack.

³ For windspeeds other than those shown, use data given for the nearest windspeed.

⁴ Multiply the figures given in the table by the appropriate factor to obtain the fractional casualties from surprise dose attack:

Troops in open foxholes:	0.7
Troops in covered foxholes or bunkers:	0.6

⁵ I=inversion, N=neutral, L=lapse.

Table 17. BZ Munitions Requirements

1	2	3	4	5	6
Munition	Casualty level ²	Area coverage ¹ (square kilometers)			
		Windspeed ³			
		8 kmph		16 kmph	
		Temperature gradient		Temperature gradient	
		Inversion	Neutral	Inversion	Neutral
150-lb bomb	.40	.05	.02	.03	.01
	.75	.03	.01	.02	.009
700-lb bomb	.40	.20	.07	.09	.04
	.75	.10	.04	.05	.03

¹Area coverages are for one bomb.

²Casualty levels are for personnel without masks available. For personnel with masks available, multiply casualty levels by 0.7.

³For windspeeds other than those shown, use data given for the nearest windspeed.

NOTE: The above table is composed of hypothetical munitions and data for INSTRUCTIONAL PURPOSES ONLY at the U. S. Army Command and General Staff College. For actual data, refer to FM 3-10.

**4.2-IN MORT/HD
105-MM HOW/HD
155-MM HOW/HD
VAPOR EFFECT**

Table 18. HD Ammunition Expenditure for Vapor Effect (50 Percent Coverage of Target Area)^{1 2}

Desired effect ³	Exposure time (hours)	Rounds required per hectare																							
		4.2-inch mortar (cartridge M2A1)								105-mm howitzer (cartridge M60)								155-mm howitzer and gun (projectiles M110 and M104)							
		Windspeed (kmph)								Windspeed (kmph)								Windspeed (kmph)							
		Temperature gradient ⁴								Temperature gradient ⁴								Temperature gradient ⁴							
		I	N	L	I	N	L	I	N	L	I	N	L	I	N	L	I	N	L	I	N	L	I	N	L
Cause eye irritation to troops without masks.	Temperature (°F)	6	9	15	26	6	9	15	26	6	9	15	26	6	9	15	26	6	9	15	26	6	9	15	26
	55° 70° 85° 100°	I	N	L	I	N	L	I	N	L	I	N	L	I	N	L	I	N	L	I	N	L	I	N	L
	1 ½ ¼ ⅛	10	14	16	11	21	22	15	22	26	20	24	29	22	24	27	24	34	39	39	44	46	32	53	65
	2 1 ½ ¼	6	8	9	8	12	14	12	13	16	17	21	24	18	22	23	20	22	27	29	32	34	26	39	51
	4 2 1 ½	6	6	8	8	9	10	9	10	13	13	16	20	16	17	20	17	18	20	20	22	24	22	29	39
Disable masked troops (sweating in humid weather).	8 4 2 1	4	6	6	6	8	9	8	9	11	12	13	15	12	15	17	13	12	17	15	20	22	18	27	36
	16 8 4 2	4	5	5	5	8	9	8	8	10	10	11	13	10	12	13	10	11	15	12	17	20	15	24	34
	1 ½ ¼ ⅛	35	46	52	39	53	63	46	63	80	59	77	108	70	83	108	77	95	121	95	123	166	108	157	243
	2 1 ½ ¼	20	29	33	24	35	40	30	45	56	41	59	69	42	54	63	47	63	84	66	89	102	82	108	192
	4 2 1 ½	15	21	24	17	27	33	24	35	42	30	47	65	27	36	45	32	47	62	48	64	84	64	88	162
Disable masked troops (dry weather).	8 4 2 1	11	17	18	13	21	26	17	28	38	27	45	63	18	29	34	24	38	47	33	53	76	54	83	138
	16 8 4 2	9	14	16	11	18	22	16	24	33	24	42	58	15	23	27	18	32	42	30	51	66	48	72	120
	1 ½ ¼ ⅛	64	83	95	72	95	114	86	113	144	108	144	198	128	154	174	144	174	212	189	...	...	202	...	...
	2 1 ½ ¼	36	52	58	44	62	72	57	81	101	71	120	125	75	98	128	89	113	147	111	156	180	148	198	288
	4 2 1 ½	26	35	41	30	46	56	45	62	76	57	86	119	50	64	81	59	86	111	88	118	153	117	165	256
	8 4 2 1	18	27	30	23	35	44	32	50	68	50	81	114	33	50	58	45	65	84	62	95	138	101	154	240
	16 8 4 2	13	21	26	18	30	40	29	46	60	42	72	108	26	39	45	34	56	72	54	84	120	84	132	193
	1 ½ ¼ ⅛	36	48	53	41	56	63	46	66	78	59	83	105	36	48	53	41	56	63	46	66	78	59	83	105
	2 1 ½ ¼	26	36	41	26	36	41	38	54	63	42	65	84	21	28	33	26	36	41	38	54	63	42	65	84
	4 2 1 ½	26	36	45	26	36	45	26	36	45	26	36	45	26	36	45	26	36	45	26	36	45	26	36	45

¹For open terrain. For heavily wooded terrain or jungle, multiply the figure obtained by 0.5 to obtain the appropriate expenditure.

²Blank spaces indicate excessive expenditures.

³An average of 50 percent casualties is expected among all troops who remain in the target area for the times specified.

⁴I = inversion, N = neutral, L = lapse.

[REDACTED]

SK

DEPARTMENT OF THE ARMY FIELD MANUAL
NAVAL WARFARE INFORMATION PUBLICATION
DEPARTMENT OF THE AIR FORCE MANUAL
MARINE CORPS MANUAL

FM 3-10B
NWIP 36-4
AFM 355-9
FMFM 11-3B

**EMPLOYMENT
OF
CHEMICAL AGENTS (U)**

This copy is a reprint which includes current
pages from Changes 1.

01 [REDACTED]

[REDACTED]

*DEPARTMENTS OF THE ARMY, THE NAVY
AND THE AIR FORCE
NOVEMBER 1966*

[REDACTED]

[REDACTED]

or mask discipline is poor, such as in counter-insurgency operations.

b. Limitations. BZ has the following limitations:

- (1) The white agent cloud produced by pyrotechnic mixtures acts as a visible alarm.
- (2) BZ may be defeated by improvised respiratory protection such as a folded cloth over mouth and nose.
- (3) The effects are not immediate but require an average onset time of about 3 to 6 hours.
- (4) There is no known antidote to treat affected friendly personnel.

c. Median Incapacitating Dosage (IC₅₀). This is about 110 mg-min/m³ for man engaged in mild activity (breathing rate of 15 liters/min).

d. Physiological and Psychological Symptoms. The symptoms listed below will become more intense as the dosage received increases. They also vary according to the inherent characteristics of each individual exposed to the agent. Because of the many variables involved, estimation of the percentage and type of casualties produced from a BZ attack is difficult. Approximations for the occurrence of ultimate casualties among unmasked personnel are 5 percent in 2 hours, 50 percent in 4½ hours, and 95 percent in 9½ hours.

- (1) Symptoms likely to appear in 30 minutes to 3 hours: dizziness, extreme drowsiness, dryness of the mouth, and increased heartbeat.
- (2) Symptoms likely to appear in 3 to 5 hours: restlessness, involuntary muscular movement, near vision impairment, and physical incapacitation.
- (3) Symptoms likely to appear in 6 to 10 hours: hallucinations, lack of muscular coordination, disorientation, and difficulty in memory recall.

e. Duration of Incapacitation. The duration of incapacitation varies with the dosage received—from 24 hours to 5 days.

f. Duration of Effectiveness. Under average meteorological conditions in the open, the aerosol is normally effective for only a few minutes after dissemination, since the fine BZ particles travel

6. (U) Incapacitating Agent BZ

This agent is disseminated as an aerosol to produce physical and mental effects when inhaled. The effects are temporary, and recovery is normally complete. There may be permanent ill effects in a few instances among the very young, the aged, and the infirm, or when massive dosages are received.

a. Tactical Employment. BZ is employed against carefully selected targets to incapacitate enemy troops when the use of lethal or destructive munitions is undesirable. This agent may be particularly useful in situations where adequate protective equipment is normally not available to enemy troops or where the status of training

27. (S) CBU-5B/M43 750-Pound BZ Cluster Bomb

Both the U.S. Air Force CBU-5B and the U.S. Army M43 750-pound cluster bombs contain 57 M138 BZ-filled bomblets. The U.S. Army M43 cluster is designed for delivery by aircraft at low speeds. When modified and equipped with a suitable fairing for streamlining purposes, an internal arming wire system, and a strengthened tail fin, it is then designated the CBU-5B and can be delivered by high-performance aircraft.

a. *Operational Concepts.* The BZ cluster bomb is used on carefully selected targets against enemy personnel when the use of lethal chemical or destructive weapon systems is militarily or politically undesirable. See paragraph 6 for additional data.

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b. *Characteristics.* The cluster contains about 85 pounds of agent BZ and employs two tail mechanical time fuzes. To function properly, the cluster must be released above 6,200 feet so as to allow the cluster to open at approximately 4,500 feet. The M138 bomblet contains four canisters, each with three-fourth pound of agent-pyrotechnic mixture (50/50 ratio), and an "all-ways" impact fuze. The bomblet is *not* self-dispersing.

c. *Capabilities.* The cluster delivers M138 bomblets over an elliptical impact area having a cross section of approximately 100 by 200 meters when released at heights above 6,200 feet. One cluster can cover about 12,000 square meters

(1.2 hectares) with an incapacitating total dosage of BZ (110 mg-min/m³) under neutral temperature gradient and in a wind speed between 2 and 10 knots; under lapse temperature gradient conditions, the area coverage will be smaller. Under optimum delivery conditions, the area coverage for one cluster is expected to range from 15,000 to 20,000 square meters. Field tests indicate that wind speed has only minor effects upon area coverage.

d. *Operational Considerations.* Refer to the appropriate technical order/flight manual to determine aircraft loads (see para 16d).

Field Manual
No 3-6

Air Force Manual
No 105-7

Fleet Marine Force Manual
No. 7-11-H

HEADQUARTERS
DEPARTMENT OF THE ARMY
DEPARTMENT OF THE AIR FORCE
UNITED STATES MARINE CORPS
Washington, DC, 3 November 1986

**FIELD BEHAVIOR OF NBC AGENTS
(INCLUDING SMOKE AND INCENDIARIES)**

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DISPERSION CATEGORY	ATMOSPHERIC DESCRIPTION	TRADITIONAL ATMOSPHERIC CONDITIONS
1	Very Unstable	Lapse
2	Unstable	Lapse
3	Slightly Unstable	Neutral
4	Neutral	Neutral
5	Slightly Stable	Neutral
6	Stable	Inversion
7	Extremely Stable	Inversion

Figure 1-1. Atmospheric stability categories and conditions.

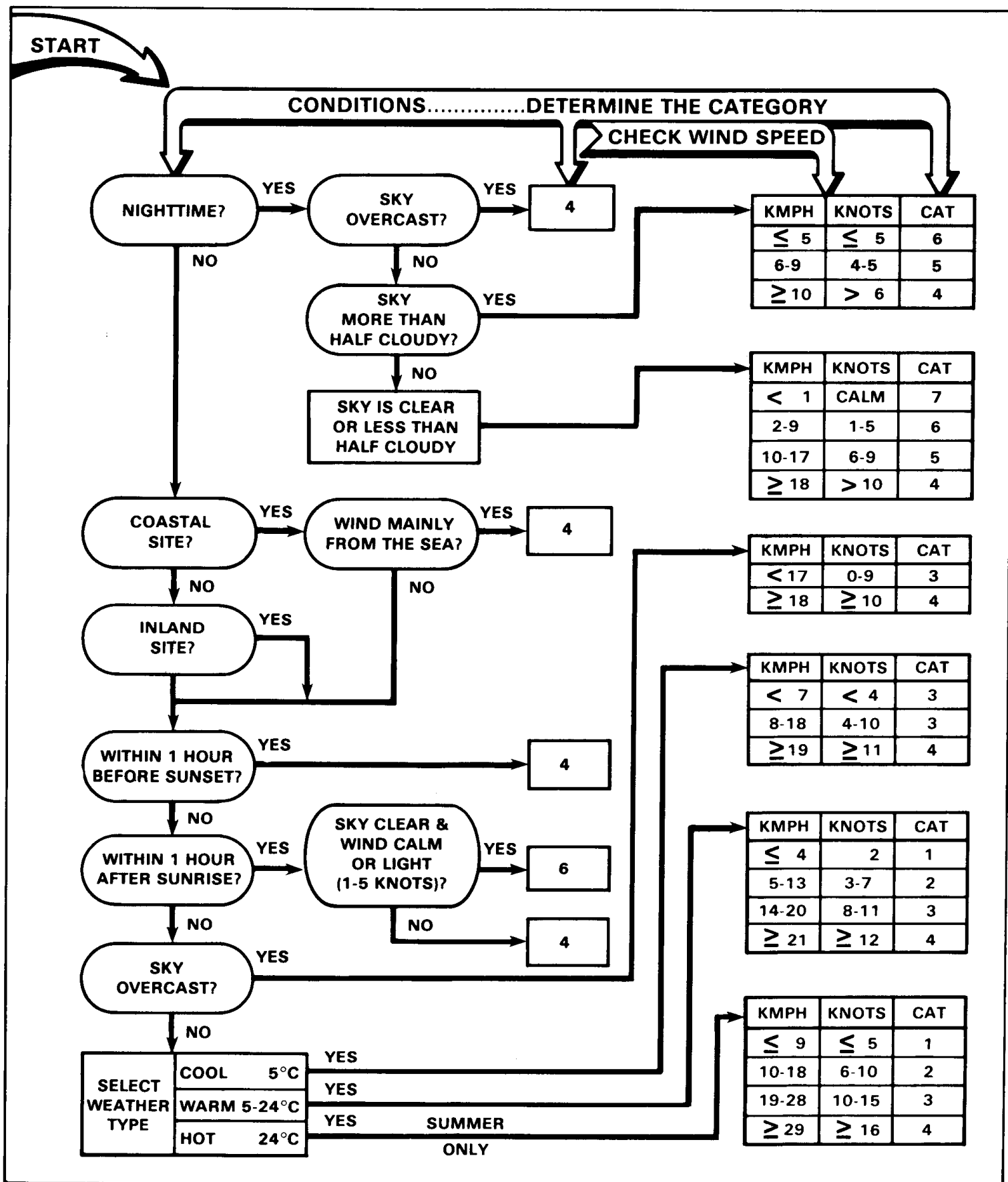


Figure 1-2. Stability decision tree.

Center line dosages at different distances downwind for different dispersion categories and wind speeds for a unit source. 100 kilograms of GB

Table 1-3. Center line dosages at different distances downwind for different dispersion

DOWNWIND DISTANCE IN KM									
Wind Speed	.5	1	2	4	6	10	20	30	
	DOSAGES (mg-min/M³)								
S T A B I L I T Y	1	57.82	10.960	2.4820	1.2070	.8048	.48290	.24140	.16100
	3	19.15	3.628	.8224	.3998	.2665	.15990	.07995	.05330
	5	11.47	2.174	.4928	.2396	.1597	.09582	.04791	.03194
C A T E G O R Y	3	65.93	16.480	4.121	1.0300	.4671	.22840	.11360	.07575
	6	32.86	8.215	2.054	.5135	.2328	.11380	.05663	.03775
	10	19.75	4.938	1.235	.3087	.1400	.06843	.03404	.02269
4	3	172.60	46.26	12.400	3.321	1.5370	.5825	.18010	.11510
	7	73.86	19.79	5.302	1.421	.6576	.2492	.07703	.04925
	12	43.09	11.55	3.094	.829	.3837	.1454	.04494	.02874
5	3	572.4	170.20	50.590	15.040	7.398	3.0260	.8997	.44450
	8	213.9	63.61	18.910	5.622	2.765	1.1310	.3363	.16620
	16	107.1	31.84	9.467	2.814	1.384	.5662	.1683	.08318
6	2	1,837.0	606.0	199.90	65.94	34.470	15.220	5.021	2.6250
	5	736.2	242.9	80.12	26.43	13.810	6.101	2.012	1.0520
	9	408.7	134.8	44.47	14.67	7.668	3.387	1.117	.5839
7	1	10,080.0	3,691.0	1,351.0	494.50	274.70	131.00	47.930	26.630
	3	3,339.0	1,222.0	447.4	163.80	90.96	43.37	15.870	8.818
	5	2,001.0	732.4	268.1	98.12	54.51	25.99	9.5120	5.284
HIGHER DOSAGES THAN ABOVE									

Table 1-4. Summary of favorable and unfavorable weather and terrain conditions for tactical employment of chemical agent vapor or aerosol. (The stability condition listed for the south slope is for the northern hemisphere; due to solar loading on the slope, the situation would be reversed for the southern hemisphere.)

FACTOR	UNFAVORABLE	MODERATELY FAVORABLE	FAVORABLE
Wind	Artillery employment if speed is more than 7 knots. Aerial bombs if speed is more than 10 knots.	Steady, 5 to 7 knots, or land breeze.	Steady, less than 5 knots, or sea breeze.
Dispersion Category	Unstable (lapse).	Neutral.	(Stable) inversion.
Temperature	Less than 4.4°C.	4.4° to 21.1°C.	More than 21.1°C.
Precipitation	Any.	Transitional.	None.
Cloud Cover	Broken, low clouds during daytime. Broken, middle clouds during daytime. Overcast or broken, high clouds during daytime. Scattered clouds of all types during daytime. Clouds of vertical development.	Thick, low overcast. Thick, middle overcast.	Broken, low clouds at night. Broken, middle clouds at night. Overcast or broken, high clouds at night. Scattered clouds of all types at night. Clear sky at night.
Terrain	Hilltops, mountain crests. South slopes* during daytime.	Gently rolling terrain. North slopes at night.	Even terrain or open water.
Vegetation*	Heavily wooded or jungle.	Medium dense.	Sparse or none.
*Cloud dissemination occurs above the canopy.			

Chemical and biological contamination avoidance, FM 3-3 (1992)

10 grams/square meter

*TABLE 1-2. Chemical Agent Persistency in Hours on
CARC Painted Surfaces.*

Temperature		GA/ GF ¹	GB ^{2,3}	GD ^{2,3}	HD ¹	VX ^{2,3}
C°	F°					
-30	-22	*	110.34	436.69	**	***
-20	-4	*	45.26	145.63	**	***
-10	14	*	20.09	54.11	**	***
0	32	*	9.44	22.07	**	***
10	50	1.42	4.70	9.78	12	1776
20	68	0.71	2.45	4.64	6.33	634
30	86	0.33	1.35	2.36	2.8	241
40	104	0.25	0.76	1.25	2	102
50	122	0.25	0.44	0.70	1	44
55	131	0.25	0.34	0.51	1	25

NOTE

- 1 For grassy terrain multiply the number in the chart by 0.4.
- 2 For grassy terrain multiply the number in the chart by 1.75.
- 3 For sandy terrain multiply the number in the chart by 4.5.
- * Agent persistency time is less than 1 hour.
- ** Agent is in a frozen state and will not evaporate or decay.
- *** Agent persistency time exceeds 2,000 hours.

CHEMICAL WEAPONS EMPLOYMENT DATA

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*This reference book replaces RB 3-2, 8 July 1981, for all resident and nonresident programs.

Section X Spray Tank/VX

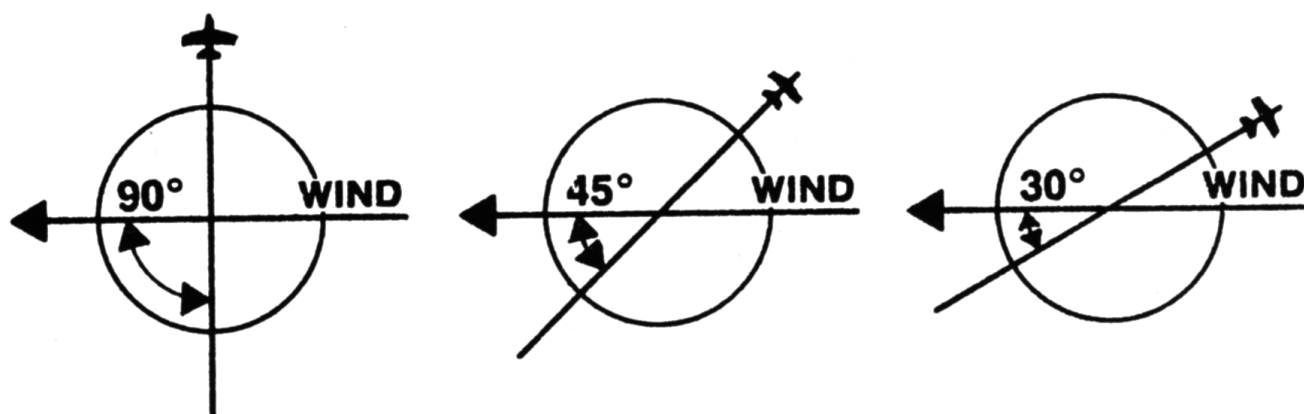
AIM POINT & FLIGHT PATH ADJUSTMENTS VARIABLE DELIVERY TECHNIQUES

DELIVERY SYSTEM
Refer to Air Force &
Navy Publications

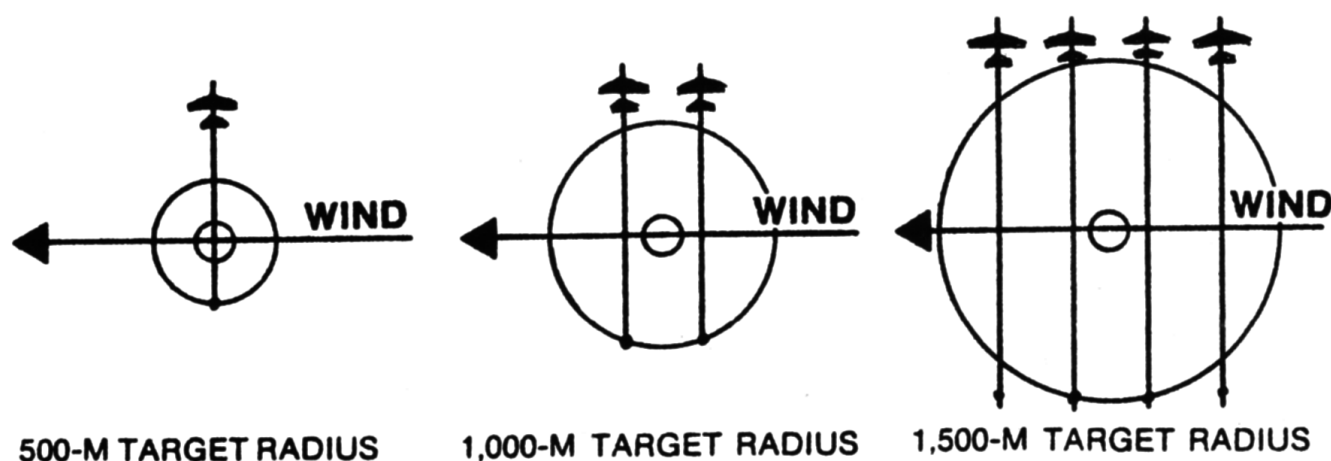
TANKS/AIRCRAFT
Minimum 1
Maximum 2

AIRCRAFT SPEED*
450 Knots
Centered Delivery

$$\text{Altitude of Spray Release Line} = \frac{\text{Windspeed} - \text{Height Product (VWH)}}{\text{Windspeed in Knots}}$$



FLIGHT PATH IN RELATION TO WIND DIRECTION



500-M TARGET RADIUS

1,000-M TARGET RADIUS

1,500-M TARGET RADIUS

Flight path Initiation point is leading edge of target Target center

*Used on all tables in this section.

Table I-79. Spray Tank/VX Aim Point & Flight Path Adjustments

Spray Tank/VX

Expected Fraction of Casualties

PROTECTION CATEGORY:
CASUALTIES WITHIN:

A (NO MASK OR PROTECTIVE CLOTHING)
1/2 HOUR

FLOW RATE	WIND ANGLE	TARGET RADIUS (Meters)	WINDSPEED-HEIGHT PRODUCT (VWH)														
			500			750			1000			2000			3000		
			NO. AIRCRAFT			NO. AIRCRAFT			NO. AIRCRAFT			NO. AIRCRAFT			NO. AIRCRAFT		
			1	2	4	1	2	4	1	2	4	1	2	4	1	2	4
ONE TANK AT HALF FLOW	90°	500	.08	.15	.20	.17	.37	.60	.25	.46	.68	.25	.43	.60	.19	.35	.50
		1000	.01	.04	.10	.06	.15	.31	.09	.19	.45	.09	.20	.45	.09	.20	.45
		1500	—	.02	.07	—	.06	.14	—	.06	.19	—	.06	.22	—	.08	.23
	45°	500	.04	.11	.23	.13	.29	.61	.20	.41	.69	.22	.41	.64	.21	.37	.57
		1000	.01	.04	.11	.04	.10	.23	.07	.16	.36	.08	.19	.42	.08	.19	.42
		1500	—	—	.07	—	.06	.12	—	.08	.18	—	.08	.20	—	.08	.22
	30°	500	.02	.07	.16	.10	.23	.48	.15	.32	.64	.17	.36	.62	.18	.35	.57
		1000	—	.03	.08	.03	.09	.20	.06	.13	.29	.07	.15	.34	.07	.16	.36
		1500	—	—	.04	—	.04	.09	—	.06	.14	—	.06	.18	—	.08	.20
TWO TANKS AT HALF FLOW	90°	500	.08	.17	.30	.22	.46	.69	.34	.55	.69	.31	.50	.65	.25	.43	.60
		1000	.01	.05	.11	.10	.19	.41	.13	.29	.61	.15	.33	.53	.18	.35	.51
		1500	.01	.03	.10	.05	.11	.25	.07	.17	.38	.09	.20	.46	.09	.22	.49
	45°	500	.06	.13	.28	.18	.37	.71	.27	.50	.71	.30	.50	.67	.29	.47	.62
		1000	.02	.06	.13	.06	.14	.31	.11	.24	.51	.13	.29	.60	.15	.32	.63
		1500	—	.02	.08	.03	.09	.20	.06	.14	.31	.07	.17	.38	.08	.19	.42
	30°	500	.04	.09	.39	.13	.29	.73	.20	.41	.69	.23	.44	.63	.24	.43	.57
		1000	.01	.04	.10	.05	.11	.26	.09	.19	.41	.10	.23	.51	.12	.26	.56
		1500	—	.01	.06	.02	.07	.14	.04	.11	.24	.06	.13	.29	.07	.15	.34

PROTECTION CATEGORY:
CASUALTIES WITHIN:

A (NO MASK OR PROTECTIVE CLOTHING)
1 HOUR

FLOW RATE	WIND ANGLE	TARGET RADIUS (Meters)	WINDSPEED-HEIGHT PRODUCT (VWH)														
			500			750			1000			2000			3000		
			NO. AIRCRAFT			NO. AIRCRAFT			NO. AIRCRAFT			NO. AIRCRAFT			NO. AIRCRAFT		
			1	2	4	1	2	4	1	2	4	1	2	4	1	2	4
ONE TANK AT HALF FLOW	90°	500	.08	.20	.27	.25	.50	.70	.36	.57	.69	.33	.53	.64	.28	.48	.58
		1000	.02	.06	.15	.10	.22	.47	.16	.34	.65	.19	.39	.65	.22	.40	.63
		1500	—	.04	.09	—	.10	.23	—	.12	.34	—	.15	.41	—	.21	.42
	45°	500	.06	.14	.30	.19	.40	.71	.28	.52	.72	.31	.52	.68	.30	.49	.64
		1000	.02	.06	.14	.07	.15	.33	.11	.25	.52	.14	.29	.55	.16	.32	.54
		1500	—	.02	.07	—	.08	.19	—	.13	.34	—	.16	.38	—	.19	.43
	30°	500	.04	.10	.22	.14	.30	.63	.21	.43	.69	.24	.45	.65	.25	.45	.59
		1000	.01	.04	.10	.05	.12	.27	.09	.19	.41	.10	.23	.48	.12	.25	.49
		1500	—	.01	.05	—	.06	.14	—	.11	.24	—	.14	.31	—	.16	.37
TWO TANKS AT HALF FLOW	90°	500	.11	.24	.41	.32	.57	.74	.39	.59	.72	.35	.55	.69	.29	.47	.66
		1000	.03	.08	.19	.13	.28	.58	.21	.43	.72	.27	.49	.71	.31	.51	.68
		1500	.01	.05	.14	.07	.16	.37	.12	.26	.56	.16	.34	.66	.19	.39	.67
	45°	500	.08	.17	.37	.23	.48	.75	.35	.57	.72	.35	.55	.68	.32	.51	.65
		1000	.03	.08	.17	.09	.20	.42	.16	.34	.67	.20	.42	.71	.24	.47	.71
		1500	.01	.03	.10	.05	.13	.28	.09	.20	.44	.12	.26	.55	.14	.30	.60
	30°	500	.05	.13	.51	.17	.37	.74	.26	.50	.71	.28	.49	.65	.28	.48	.64
		1000	.02	.05	.13	.07	.16	.34	.12	.26	.55	.16	.33	.67	.18	.38	.69
		1500	—	.02	.07	.03	.10	.20	.07	.15	.35	.10	.19	.43	.10	.23	.48

Table I-80. Spray Tank/VX Expected Fraction of Casualties

Expected Fraction of Casualties

Spray Tank/VX

PROTECTION CATEGORY:
CASUALTIES WITHIN:

A (No MASK OR PROTECTIVE CLOTHING)
ULTIMATE

FLOW RATE	WIND ANGLE	TARGET RADIUS (Meters)	WINDSPEED-HEIGHT PRODUCT (VWH)														
			500			750			1000			2000			3000		
			NO. AIRCRAFT			NO. AIRCRAFT			NO. AIRCRAFT			NO. AIRCRAFT			NO. AIRCRAFT		
			1	2	4	1	2	4	1	2	4	1	2	4	1	2	4
ONE TANK AT HALF FLOW	90°	500	.14	.31	.43	.39	.62	.74	.39	.59	.69	.35	.55	.65	.30	.50	.60
		1000	.05	.12	.26	.18	.38	.69	.30	.54	.73	.35	.56	.70	.36	.56	.68
		1500	—	.06	.15	—	.21	.42	—	.31	.56	—	.34	.59	—	.41	.59
	45°	500	.10	.23	.49	.30	.56	.75	.39	.60	.72	.36	.56	.68	.33	.53	.65
		1000	.04	.10	.22	.12	.26	.53	.19	.39	.63	.23	.43	.61	.26	.44	.59
		1500	—	.06	.12	—	.16	.33	—	.27	.54	—	.35	.62	—	.41	.65
	30°	500	.07	.16	.36	.22	.45	.74	.30	.54	.69	.31	.52	.65	.30	.50	.60
		1000	.03	.07	.16	.09	.20	.42	.14	.29	.55	.16	.34	.56	.18	.35	.55
		1500	—	.04	.09	—	.12	.25	—	.20	.45	—	.27	.55	—	.33	.59
TWO TANKS AT HALF FLOW	90°	500	.18	.38	.64	.43	.64	.75	.39	.59	.73	.35	.55	.70	.30	.50	.67
		1000	.06	.15	.30	.21	.45	.74	.35	.59	.73	.39	.60	.71	.39	.59	.69
		1500	.04	.09	.22	.13	.28	.60	.22	.46	.72	.30	.54	.74	.34	.56	.72
	45°	500	.13	.28	.58	.35	.60	.75	.40	.61	.72	.36	.56	.68	.34	.53	.65
		1000	.05	.11	.27	.16	.33	.66	.27	.52	.75	.33	.57	.73	.37	.59	.72
		1500	.03	.06	.16	.10	.21	.44	.16	.34	.65	.21	.42	.69	.24	.46	.68
	30°	500	.09	.20	.72	.26	.51	.74	.33	.56	.74	.32	.53	.70	.31	.50	.67
		1000	.04	.09	.20	.12	.26	.54	.20	.41	.73	.25	.49	.74	.29	.53	.73
		1500	.02	.04	.12	.07	.16	.32	.12	.25	.52	.15	.30	.60	.17	.34	.61

Table I-81. Spray Tank/VX Expected Fraction of Casualties

Section XI

HD Munitions

HD DOSAGE REQUIREMENTS

HD DOSAGES mg/minute/cubic meter			PERSONNEL PROTECTION CATEGORY	CASUALTY EFFECTS	DEGREE OF DISABILITY	ONSET TIME	DURATION
HOT ¹	WARM ²	COOL ³					
50	50	50	"A" no mask or protective clothing	No significant injury; maximum safe dosage	--	--	--
100	100	100		Eye damage of threshold military significance	PARTIAL	6-24 HR	1-3 DAYS
200	200	200		Temporary blindness	TOTAL	3-12 HR	2-7 DAYS
100	150	400	"B" or "C" with no protective clothing	No significant injury; maximum safe dosage	--	--	--
200	300	1,000		Skin burns of threshold military significance	PARTIAL	2-12 DAYS	1-2 WEEKS
500	1,000	2,000 to 4,000		Severe genital burns	PARTIAL TO TOTAL	2-7 DAYS	1-4 WEEKS
750	2,000 to 4,000	4,000 to 10,000		Severe generalized burns	PARTIAL TO TOTAL	4-12 HRS About 24 HRS	3-4 WEEKS 1-2 WEEKS
			"D" mask with protective clothing	HD IS NOT RECOMMENDED FOR USE IN THIS PROTECTION CATEGORY.			

¹Hot, humid; above 80°F; sweating skin

²Warm; 60°-80°F; skin not wet with sweat

³Cool; 40°-60°F; cool, dry skin

Table I-85. HD Munitions

HD Contamination Replenishment Time (Rate Factors)

$$\begin{array}{ccccccc} \text{TERRAIN} & & & & & & \\ \text{FACTOR} & \times & \text{WINDSPEED} & \times & \text{GROUND} & \times & \text{TEMPERATURE} \\ & & \text{FACTOR} & & \text{SURFACE} & & \text{GRADIENT} \\ & & & & \text{TEMPERATURE} & & \text{FACTOR}^2 \\ & & & & \text{FACTOR} & & \text{(STABILITY)} \\ & & & & & = & \text{TIME (HOURS)} \\ & & & & & & \text{FOR 50\%} \\ & & & & & & \text{EVAPORATION} \\ & & & & & & \text{OF HD} \end{array}$$

FACTORS

TERRAIN	WINDSPEED ¹ (knots)	GROUND SURFACE TEMPERATURE (°F)	TEMPERATURE GRADIENT ²
OPEN GRASSLAND = 1	1 = 3.1 2 = 1.8 3 = 1.3 4 = 1.0	50° = 4.0 60° = 2.5 70° = 1.6 80° = 1.0 90° = 0.6 100° = 0.4 110° = 0.3 120° = 0.2	INVERSION = 1.2 NEUTRAL = 1.0 LAPSE = 0.7
FOREST OR JUNGLE = 1	5 = 0.8 6 = 0.7 7 = 0.6 9 = 0.5 11 = 0.4		
BARREN SOIL OR SAND = 2	14 = 0.3 18 = 0.3		

¹at 2 meters high in the open
²in the open

Table I-96. HD Contamination Replenishment Time (Rate Factors)

Approximate Duration of Hazard in Contaminated Terrain

TASK	TERRAIN	APPROXIMATE TIME AFTER CONTAMINATION THAT PRESCRIBED TASKS MAY BE PERFORMED WITH NEGLIGIBLE RISK ¹ (Not wearing protective clothing) ²			
		BLISTER AGENT (HD)		NERVE AGENT (VX-GB)	
		TEMPERATURE ³		UNIFORM ⁴	
		WARM (70°-85°F)	HOT (80°-100°F)	SUMMER	WINTER
TRAVERSAL⁵ (Walking across area 2 hours or less)	Bare soil or low vegetation ⁶ (except sand)	WEARING MASKS			
	High vegetation, including jungle and heavy woods	36 HOURS	36 HOURS	5 HOURS	2 HOURS
OCCUPATION (Without hitting ground 24 hours)	Bare soil or low vegetation ⁶ (except sand)	NOT WEARING MASKS⁷			
	High vegetation, including jungle and heavy woods	4 DAYS	3 DAYS	32 DAYS	13 DAYS
OCCUPATION (Involving advance under fire 24 hours)	Bare soil or low vegetation ⁶ (except sand)	4 DAYS	3 DAYS	32 DAYS	13 DAYS
	High vegetation including jungle and heavy woods	6 DAYS	4 DAYS	50 DAYS	18 DAYS

¹These times are safe-sided for troop safety.

²Leather combat boots treated with protective dubbing or rubber combat boots are worn.

³Effects of blister agent vary significantly with temperature. Mustard freezes in temperatures below 60°F and can present a hazard when the temperature rises.

⁴Protection from V-agent and thickened G-agent varies significantly with layers of clothing worn.

⁵For personnel walking for 2 hours in an area contaminated by blister agents, the limiting factor is the vapor hazard. If only a few minutes are required for traversal of the area, the task can be initiated at earlier times than those given.

⁶Times shown are not applicable to sand, which will hold chemical agents for longer periods of time than those given.

⁷The data refer to approximate times at which personnel could occupy contaminated areas without having to wear protective masks for protection against vapor hazard.

Table I-97. Approximate Duration of Hazard in Contaminated Terrain

WARNING

This table is intended as a guide only.
Chemical agent detectors must be used to determine the extent
of actual contamination and vapor hazards.

Table 5-2. Potential Biological Warfare Agents.

Microorganism	Mode of Transmission	Incubation Period (Days) ²	Mortality Rate (Percent) ²	Vaccine (³)	Treatment (⁴)
Bacteria					
Bacillus Anthracis (Anthrax)	A, D ⁹ , I	1-7	5-1005	+	E ⁶
Francisella Tularensis (Tularemia)	A, D ⁹ , I, V	1-10	<30	++	E
Yersinia Pestis (Plague)	A, V	2-6	25-1007	++	E ⁶
Vibrio Cholerae (Cholera)	I	1-5	15-90	++	E
Corynebacterium Diptheriae (Diptheria)	A, D ⁹	2-5	5-12	++	E
Salmonella Typhi (Typhoid Fever)	I	6-21	7-14	++	E
Rickettsiae					
Rickettsia SPP (Spotted fevers group)	V	6-15	10-40	++	E
Rickettsiae (Endemic or flea-borne typhus)	V	6-14	2-5	N	E
Rickettsia (Rocky Mountain spotted fever)	V	3-10	30 (approx)	N	E
Coxiella Burnetii (Q fever)	A, I	14-21	<1	++	E

¹Transmission can be by aerosol-A, direct contact-D, ingestion-I, and/or vector-V.

²Incubation periods and mortality rates vary according to a number of factors (such as ability of the host to resist infection, infective dose, portal of entry, and virulence of the microorganism).

³ + indicates vaccine available but of questionable value; ++ indicates vaccine available, but mainly used in high risk individuals; +++ indicates vaccine used extensively; N indicates no vaccine available.

⁴ E indicates effective treatment available; N indicates no specific treatment.

⁵ The mortality rate is lower when the agent enters through the skin; higher when it enters through the respiratory tract.

⁶ Treatment must be initiated in the earliest stage of the pulmonary form to be effective.

⁷ The 25 percent represents mortality due to bubonic form; 100 percent represents mortality due to pneumonic form.

⁸ Mosquitoes are thought to be the primary vectors, but this has not been proven.

⁹ Direct contact refers to being bitten by a rabid animal, which is the usual means of transmission, or coming into contact with a rabid animal.

Table 5-2. Potential Biological Warfare Agents (continued).

Microorganism	Mode of Transmission	Incubation Period (Days) ²	Mortality Rate (Percent) ²	Vaccine (³)	Treatment (⁴)
Viruses					
Eastern Equine Encephalitis (EEE)	V ⁸	4-24	60 (Approx)	N	N
Venezuelan Equine Encephalitis (VEE)	V ⁸	4-24	<1	+	N
Japanese B Encephalitis	V (Mosquito)	5-15	10-80	+	N
Russian Spring Summer Encephalitis (RSSE)	V (Tick)	7-14	3-40	+	N
Yellow Fever	V (Mosquito)	3-6	5-40	+	N
Dengue Fever	V (Mosquito)	4-10	<1	+	N
Pox Virus					
Varicella Virus (Smallpox)	A, D ⁹	7-16	10-25	+	N
Hantaan Virus (Hemorrhagic Fever with Renal Syndrome)	A, V			+	
Phlebovirus (Rift Valley Fever)	V (Mosquito)	4-6	<1	N	N
Nairovirus (Crimean-Congo Hemorrhagic Fever)	V (Tick)	3-7			
Bunyavirus (LA Crosse)	V (Mosquito)				
Phlebovirus (Sandfly)	V (Sand fly)	3-6			

¹ Transmission can be by aerosol-A, direct contact-D, ingestion-I, and/or vector-V.

² Incubation periods and mortality rates vary according to a number of factors (such as ability of the host to resist infection, infective dose, portal of entry, and virulence of the microorganism).

³ + indicates vaccine available but of questionable value; + + indicates vaccine available, but mainly used in high risk individuals; + + + indicates vaccine used extensively; N indicates no vaccine available.

⁴ E indicates effective treatment available; N indicates no specific treatment.

⁵ The mortality rate is lower when the agent enters through the skin; higher when it enters through the respiratory tract.

⁶ Treatment must be initiated in the earliest stage of the pulmonary form to be effective.

⁷ The 25 percent represents mortality due to bubonic form; 100 percent represents mortality due to pneumonic form.

⁸ Mosquitoes are thought to be the primary vectors, but this has not been proven.

⁹ Direct contact refers to being bitten by a rabid animal, which is the usual means of transmission, or coming into contact with a rabid animal.

Table 5-3. Threat Toxins.

Type of Toxin	Means of ID	Symptoms in Man	Effects on Man	Rate of Action	How Normally Disseminated	Protection Required	Decontamination
Mycotoxins	None	Vomiting, eye and skin irritation, dizziness, bloody diarrhea, and blisters.	Can incapacitate or kill, depending on concentration.	Rapid	Dusts, droplets, aerosols, or smokes, or covert means	Protective mask and protective clothing	Soap and water, bleach, M258-series kit, STB and DS2
Enterotoxins	None	Severe vomiting and diarrhea, painful cramps, and weakness	Primarily incapacitates, assuming proper first aid is conducted	Same as above	Same as above	Same as above	Same as above
Botulinum Toxin	None	Double vision, weakness, difficulty in speech and swallowing, and respiratory paralysis	Kills	Delayed	Same as above	Same as above	Same as above

POTENTIAL MILITARY CHEMICAL/BIOLOGICAL AGENTS AND COMPOUNDS, US Army FM 3-11.9, 2005

Table G-4. Toxicity Estimates for CW Agents

ROE	Liquid (mg/70 kg man)		Inhalation/Ocular (mg-min/m³)		Inhalation (mg/m³) Odor Detection (EC ₅₀)	Ocular (mg-min/m³)		Percutaneous Vapor (mg-min/m³)					
	Lethal (LD ₅₀)	Severe (ED ₅₀)	Lethal (LC ₅₀)	Severe (EC ₅₀)		Mild (EC ₅₀)	Severe (EC ₅₀)	Lethal (LC ₅₀)		Severe (EC ₅₀)			
								Moderate	Hot	Moderate	Hot		
Endpoints													
Choking Agents	CG	-	-	1,500 (2-60)	-	6 S	-	-	-	-	-	-	-
	DP	-	-	1,500P (10-60)	-	4 S	-	-	-	-	-	-	-
Nerve Agents	GA	1,500	900	70 (2)	50 (2)	0.4 (2)	-	-	15,000 (30-360)	7,500P (30-360)	12,000 (30-360)	6,000P (30-360)	6,000P (30-360)
	GB	1,700	1,000	35 (2)	25 (2)	0.4 (2)	-	-	12,000 (30-360)	6,000P (30-360)	8,000 (30-360)	4,000P (30-360)	4,000P (30-360)
	GD	350	200	35 (2)	25 (2)	0.2 (2)	-	-	3,000 (30-360)	1,500P (30-360)	2,000 (30-360)	1,000P (30-360)	1,000P (30-360)
	GF	350	200	35 (2)	25 (2)	0.2 (2)	-	-	3,000 (30-360)	1,500P (30-360)	2,000 (30-360)	1,000P (30-360)	1,000P (30-360)
	VX	5	2	15 (2-360)	10 (2-360)	0.1 (2-360)	-	-	150 (30-360)	75P (30-360)	25 (30-360)	12P (30-360)	12P (30-360)
	Vx	NR											
Blood Agent	AC	-	-	2860P (2)	NR		34 S	-	-	-	-	-	-
	CK	-	-	NR	NR		12 S	-	-	-	-	-	-
	SA	-	-	7,500P (2)	-	-	-	-	-	-	-	-	-
Blister Agents	HD	1400	600	1,000 (2)	-	0.6 – 1 S	75 (2-360)	25 (2-360)	10,000 (30-360)	5,000P (30-360)	500 (30-360)	200 (30-360)	200 (30-360)
	HN-1	1400P	600P	1,000P (2)	-	-	75P (2)	25P (2)	10,000P (30)	5,000P (30)	500P (30)	200P (30)	200P (30)
	HN-2	1400P	600P	1,000P (2)	-	-	75P (2)	25P (2)	10,000P (30)	5,000P (30)	500P (30-360)	200P (30-360)	200P (30-360)
	HN-3	1400P	600P	1,000P (2-360)	-	-	75P (2-360)	25P (2-360)	10,000P (30-360)	5,000P (30-360)	500P (30-360)	200P (30-360)	200P (30-360)
	HT	1400P	600P	1,000P (2-360)	-	-	75P (2-360)	25P (2-360)	10,000P (30-360)	5,000P (30-360)	500P (30-360)	200P (30-360)	200P (30-360)
	L	1400P	600P	1,000P (2-360)	-	-	75P (2-360)	25P (2-360)	5,000 - 10,000P (30-360)	2,500 - 5,000P (30-360)	500P (30-360)	200P (30-360)	200P (30-360)
	HL	1400P	600P	1,000P (2-360)	-	-	75P (2-360)	25P (2-360)	10,000P (30-360)	5,000P (30-360)	500P (30-360)	200P (30-360)	200P (30-360)

It may be several weeks or even months before I shall ask you to drench Germany with poison gas, and if we do it, let us do it one hundred per cent. In the meanwhile, I want the matter to be studied in cold blood by sensible people and not by that particular set of psalm-singing uninformed defeatists which one runs across now here, now there (Churchill 1944).

Gilbert M (1991). *Churchill. A Life*, pp. 782–783.
London: Heinemann.

ADA488135

**USAWC RESEARCH ELEMENT
(Research Paper)**

What's Wrong With Gas Warfare?

by

**Lt Col Stanley D. Fair
Chemical Corps**

**US Army War College
Carlisle Barracks, Pennsylvania
8 April 1966**

PUBLIC INFORMATION PROGRAM

A new national policy on gas warfare such as the one presented above can provide the necessary guidance for the people as to the importance of gas weapons and their role. The formulation of policy must precede or accompany any attempt to educate the public on gas warfare since "public knowledge of facts is not understanding until it can be set in the framework of policy and goals."¹¹

Public resistance to a new policy may occur because of false impressions about gas warfare. Since the American people have considerable influence on adoption of policy, they must be provided objective information on gas warfare. As "Elihu Root...wrote... when policy on foreign affairs is largely dominated by the people, the danger lies in mistaken beliefs and emotions."¹²

The issue of gas warfare is emotional and political. In this respect it is similar to many issues facing our government today; communism and race relations are examples. Government officials have led the way with free and open discussions on these controversial subjects and should do the same with gas warfare. This leadership is essential, as Major General W.M. Creasy warned a House Science Committee in 1959:

¹¹"Public Understanding--The Ultimate Weapon?" The General Electric Defense Quarterly, Vol. 3, Oct.-Dec. 1960, p. 33.

¹²William Albig, Modern Public Opinion, p. 12.

Albig, William. Modern Public Opinion. New York: McGraw-Hill, 1956. (HM261 A451)

I do not believe the American people are going to read any information on a subject when the American government says this is too horrible to use and we are not going to use it.¹³

The first step in a public information program is to go after the roots of public hostility towards gas warfare: World War I propaganda. The effects of the Allied propaganda did not evaporate with the gas clouds of World War I "for that half-century-old vision of the blue-faced men at Ypres choking to death, has left an indelible impression upon the mind of the world."¹⁴ As late as 1953 the horrors of the first gas attack were brought out in the memoirs of a war correspondent who served with the Red Cross at Ypres:

This horror was too monstrous to believe at first... the savagery of it, of the sight of men choking to death with yellow froth, lying on the floor and out in the fields, made me rage with an anger which no later cruelty of man...ever quite rekindled; for then we still thought all men were human.¹⁵

The tragedy of the first gas attack should be admitted in any program of public information: the soldiers were helpless; those who did not panic and run suffered a slow and painful death. On the other hand, it should be pointed out that protection against chlorine was simple and was achieved before the second gas attack took place two days later. Ypres was an isolated incident.

¹³Quoted in US Congress, House, Committee on Science and Astronautics, Chemical, Biological and Radiological Warfare Agents, p. 22.

¹⁴Hanson W. Baldwin, "After Fifty Years the Cry of Ypres Still Echoes--'GAS!'," New York Times Magazine, 18 Apr. 1965, p. 50.

¹⁵Geoffrey W. Young, The Grace of Forgetting, p. 233.

The best counter to propaganda is to tell the truth. In getting the facts to the public it is important to differentiate between information which can and cannot be made available to the public. They should know in general what is going on, but the details must remain classified to protect national security. It is important also to differentiate between information which should and should not be made available to the public. Articles on gas warfare should pass the test of one criterion before release by the Department of Defense: does it contribute to public understanding of gas warfare, or does it add to the misconceptions of mystery and indecency?

The free and open discussion on nuclear warfare has resulted in the willingness of the responsible American to accept the nuclear weapon as an unpleasant fact, essential to his country's safety. The current secrecy surrounding gas warfare can create a lack of confidence in the capabilities of gas. Captain Liddell Hart told of British tanks developed during World War II that were fitted with special searchlights for blinding the enemy as well as for night firing. This invention was "kept so secret that the commanders in the field regarded them distrustfully and thus repeatedly hesitated to employ such unfamiliar instruments."¹⁹

¹⁹B.H. Liddell Hart, Deterrent of Defense, pp. 86-87.

CIVIL DEFENCE

why we need it





Message from the Home Secretary and the Secretary of State for Scotland

For over 30 years our country, with our allies, has sought to avoid war by deterring potential aggressors. Some disagree as to the means we should use. But whatever view we take, we should surely all recognise the need – and indeed the duty – to protect our civil population if an attack were to be made upon us; and therefore to prepare accordingly.

The Government is determined that United Kingdom civil defence shall go ahead. The function of civil defence is not to encourage war, or to put an acceptable face on it. It is to adapt ourselves to the reality that we at present must live with, and to prepare ourselves so that we could alleviate the suffering which war would cause if it came.

Even the strongest supporter of unilateral disarmament can consistently give equal support to civil defence, since its purpose and effect are essentially humane.

Robert as George Younger.

Why bother with civil defence?

Why bother with wearing a seat belt in a car? Because a seat belt is reckoned to lessen the chance of serious injury in a crash. The same applies to civil defence in peacetime.

War would be horrific. Everyone knows the kind of devastation and suffering it could cause. But while war is a possibility – however slight – it is right to take measures to help the victims of an attack, whether nuclear or ‘conventional’.

But isn't it a waste of money in these days of nuclear weapons and the dreadful prospects of destruction?

No. It is money well spent if it shows people how they can safeguard themselves and their families.

But surely there is no real protection against a nuclear attack?

Millions of lives could be saved, by safeguards against radiation especially. But civil defence is not just protection against a nuclear attack. It is protection against *any* sort of attack. NATO experts reckon that any war involving the UK is likely at least to start with non-nuclear weapons. Indeed, while no war is likely so long as we maintain a credible deterrent, the likelihood of a nuclear war is less than that of a ‘conventional’ one.

But doesn't civil defence get people more war-minded, thus increasing the risk of conflict?

That is like saying people who wear seat belts are expecting to have more crashes than those who do not. Taking civil defence seriously means seeking to save lives in the catastrophe of an attack on our country.

To Sum Up

The case for civil defence stands regardless of whether a nuclear deterrent is necessary or not. Radioactive fallout is no respecter of neutrality. Even if the UK were not itself at war, we would be as powerless to prevent fallout from a nuclear explosion crossing the sea as was King Canute to stop the tide. This is why countries with a long tradition of neutrality (such as Switzerland and Sweden) are foremost in their civil defence precautions.

Civil defence is common sense

Further information:

Nuclear Weapons

ISBN 0 11 34055 X

HMSO £3.50 (net)

Protect and Survive

ISBN 0 11 3407289

HMSO 50p (net)

Domestic Nuclear Shelters

ISBN 0 11 3407378

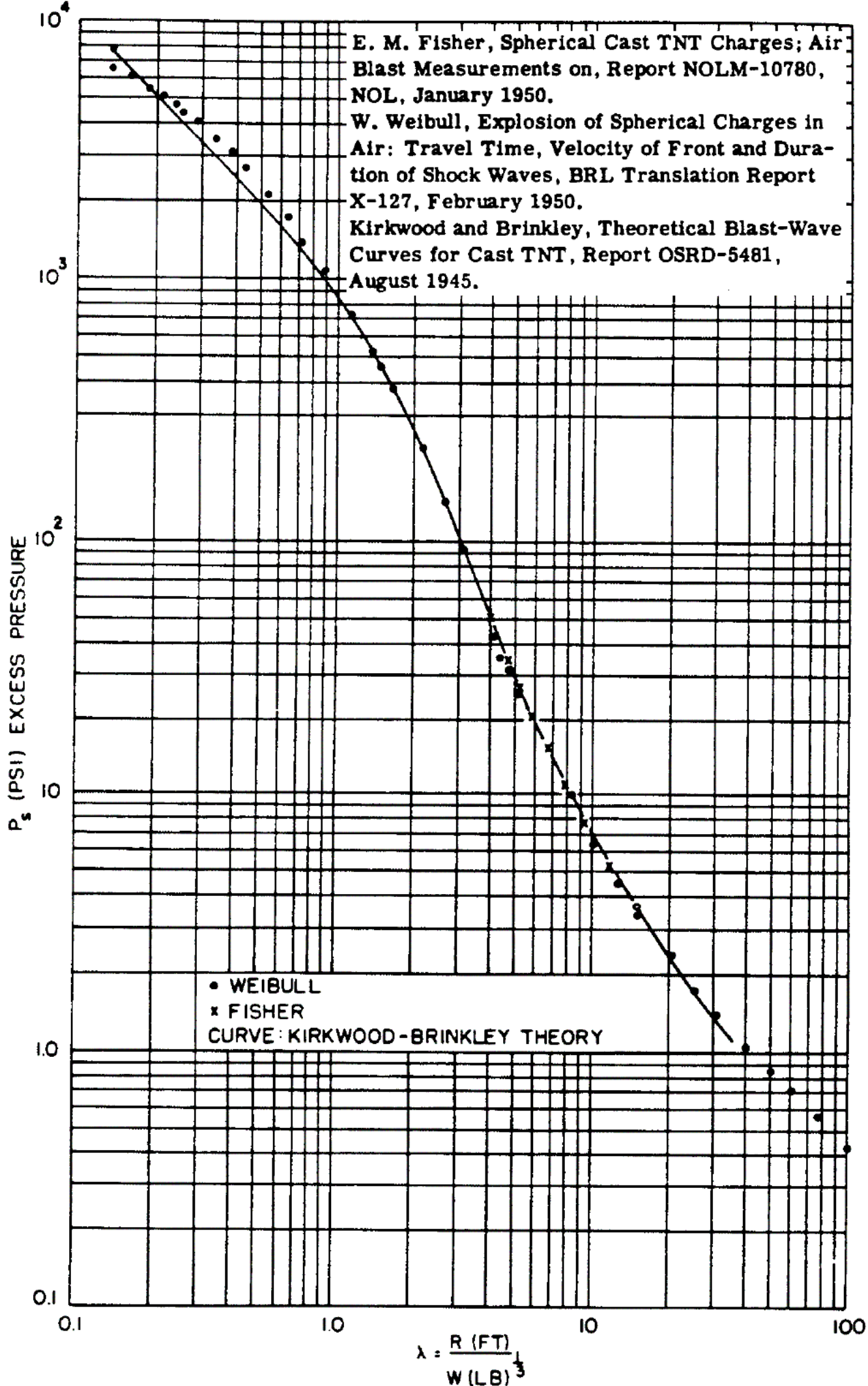
HMSO 50p (net)

Domestic Nuclear Shelters –

Technical Guidance

ISBN 0 11 34073786

HMSO £5.50 (net)



Free-air-pressure vs Distance Curve for Spherical TNT

AN ANALYSIS OF 259 OF THE RECENT FLYING-BOMB CASUALTIES

BY

R. C. BELL, M.B., M.R.C.S.*Resident Surgical Officer to an E.M.S. Hospital*

In all we dealt with 222 out-patients and 259 in-patients, with 18 deaths. Our story began in June, 1944, when the first large incident occurred near by. Twenty-six casualties were admitted and 12 required theatre treatment. This proportion remained fairly constant throughout the series. Altogether we had 83 theatre cases out of 259 admissions, and had to send 35 cases on untreated, most of whom required the theatre. In this first incident no fewer than 16 of the casualties were due to flying glass. It was noticeable how the proportion of glass injuries dropped as the importance of taking adequate cover was realized, while the percentage of crush injuries increased from people being trapped by falling masonry.

A. Flying Glass

This was the most frequent cause of injury, totalling over 100 casualties in all. Many included severe damage to the eyes. It is noticeable that most of the injuries were above the nipple line, chiefly of the face and neck: a large proportion were received when looking out of windows—a modern version of curiosity killing the cat. We had five cases of perforating wounds of both eyes and ten perforating wounds of one eye. The globe was usually completely destroyed. Many of these injuries were avoidable, and therein lay their great sadness.

The penetrating power of flying glass is, in the main, low. It is unusual for it to pierce the deep fascia: usually it lies just under the skin in the fat, but when present in hundreds of pieces it presents a problem which has not yet acquired a satisfactory solution; nor has the condition made its way into the textbooks of war surgery.

TABLE I.—*Glass*

Description	No.	Remarks	Deaths
Lacerations of face, scalp, and neck ..	77	19 T	—
Perforating wounds of eye	15	5 cases bilateral 2 T	—
Cut hands	9		
Severe multiple lacerations	6	1 T	1
Other injuries	5	—	—

(THIS DOCUMENT IS THE PROPERTY OF HIS BRITANNIC MAJESTY'S GOVERNMENT)

S E C R E T.

C A B I N E T.

Copy No. 61

C.P.108(37).

AIR RAID PRECAUTIONS - HOUSEHOLDERS' HANDBOOK.

Memorandum by the Home Secretary.

1. I circulate herewith, for the approval of the Cabinet, the Handbook which the Air Raid Precautions Department have prepared for issue to members of the general public, setting out the information which they should have to enable them to provide such protection in their homes as may be possible.

The issue of this Handbook should be free and distribution should be made to every householder in Great Britain on a basis similar to that of the Highway Code. Additional copies would be obtainable at any time at the price of 1d. at all Post Offices.

2. The Department have been engaged for the best part of twelve months in the compilation of the text and the layout of the book. Assistance has been given by a firm of publicity agents and, in addition, a wide range of outside people has been consulted. A number of Ministers have also been good enough to give the benefit of their advice to the Air Raid Precautions Department. In fact, every step has been taken that is possible to ensure that the book, while containing the essential information which the general public require, is presented in the best form possible, having regard to its purport and its message.

The Treasury have been consulted at every stage and have seen a draft of this covering note.

3. At the request of the Treasury I wish to put before my Colleagues the question of the inclusion of advertisements. There is space on the cover for two advertisements at least, and the Treasury inform me they are satisfied that a revenue of

£5,000 net could be obtained from these two pages alone.

Care would of course be exercised in the selection of firms for the purpose; but it is thought that no objection could be taken to the inclusion of advertisements by firms of such standing as H.M.V. and Bovril, both of whom are, in fact, known to be willing to pay at the rate mentioned above for these pages. Alternatively, there is the possibility of using the space for advertisements by Government Departments such as the Post Office or by the Milk Marketing Board, to be paid for at the market rate out of their authorised grants for publicity.

4. I am disposed to recommend that, with a view to reducing the cost of the Handbook as far as possible, the principle of inserting advertisements should be approved, but that in the first place efforts should be made to use the space for advertisements of this latter kind; but that if the whole space cannot be disposed of at a fair rate in this way, offers should be accepted from commercial firms or other bodies of first class reputation.

It is estimated that the cost of production and distribution would be between £30,000 and £35,000, reducible by, say, £5,000 if advertisements are accepted.

5. Owing to the length of time which must be allowed for the printing of the enormous number of copies required (say 14 millions), it would, in any case, be impossible for the issue of the book to take place before July, and for various reasons it might be desirable to postpone its issue until after the summer holidays. If my Colleagues approve, I should be glad to have discretion as to the actual time. I would, of course, give them information of the date which I would select.

The very greatest importance is attached to the issue of this Handbook, not only because of its value in instructing the public in the simple measures which they can take for their own safety, but as a means also of awakening attention to this most

vital and important part of our National Defence Schemes. I trust that my Colleagues will agree with me that the Handbook in its present form will fulfil the purpose for which it is required.

J.S.

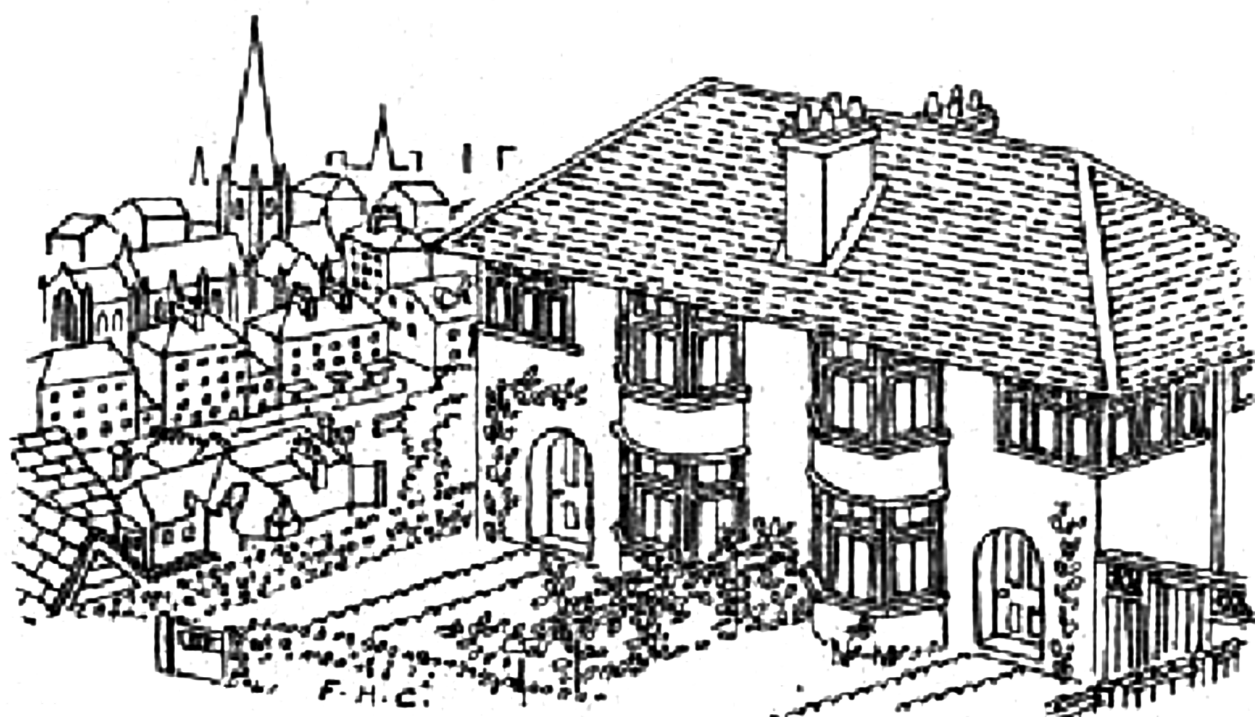
31st March, 1937.

3rd Proof



HOME OFFICE

THE PROTECTION OF YOUR HOME AGAINST AIR RAIDS



*"In the protection of your home
lies the security of your country"*

KEEP THIS BOOK CAREFULLY

Why this book has been sent to you

In the factory precautions are taken against unexpected accident. Cinemas and theatres are built so as to guard against the dangers of fire. The health of the community is safeguarded by precautions against the spread of epidemics. We have a great record in our country for common-sense, for the kind of forethought that reduces the ordinary risks of life to a minimum. The householder is now called upon to take precautions against a possibility we all hope will never arise. It would be folly to know of the existence of such a possibility, however remote, without acknowledging the need for precautions against it.

The Government is taking precautions against air raids and, with the help of Local Authorities everywhere, is organising measures to reduce the effects as far as possible. But the householder must play his part. This book is being sent to you in the confident belief that you will regard it as your duty to read it, to keep it by you, and to act upon it in any premises for which you are responsible ; so that if your home or place of business were ever in danger of being attacked from the air, you would know what to do for your own safety and the safety of those who depend upon you.

If ever we are exposed to hostile air attack, we must look to the combination of active defence and civil air raid precautions to defeat the aims of the enemy. There is a duty on every citizen to bear his part in these civil precautions, but those who for any reason cannot take them for themselves need not be worried. They will not be overlooked.

(Signed)



HOME OFFICE

THE PROTECTION OF YOUR HOME AGAINST AIR RAIDS

**READ THIS BOOK THROUGH
THEN
KEEP IT CAREFULLY**

HOW TO CHOOSE A REFUGE-ROOM

Almost any room will serve as a refuge-room if it is soundly constructed, and if it is easy to reach and to get out of. Its windows should be as few and small as possible, preferably facing a building or blank wall, or a narrow street. If a ground floor room facing a wide street or a stretch of level open ground is chosen, the windows should if possible be specially protected (see pages 30 and 31). The stronger the walls, floor, and ceiling are, the better. Brick partition walls are better than lath and plaster, a concrete ceiling is better than a wooden one. An internal passage will form a very good refuge-room if it can be closed at both ends.

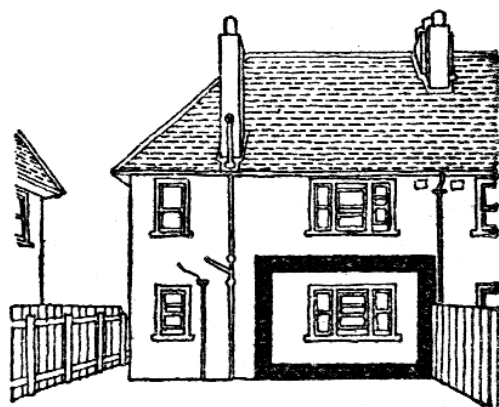
The best floor for a refuge-room

A cellar or basement is the best place for a refuge-room if it can be made reasonably gas-proof and if there is no likelihood of its becoming flooded by a neighbouring river that may burst its banks, or by a burst water-main. If you have any doubt about the risk of flooding ask for advice from your local Council Offices.

Alternatively, any room on any floor below the top floor may be used. Top floors and attics should be avoided as they usually do not give sufficient protection overhead from small incendiary bombs. These small bombs would probably penetrate the roof but be stopped by the top floor, though they might burn through to the floor below if not quickly dealt with.



A cellar or basement is the best position for a refuge-room if it can be made reasonably gas-proof

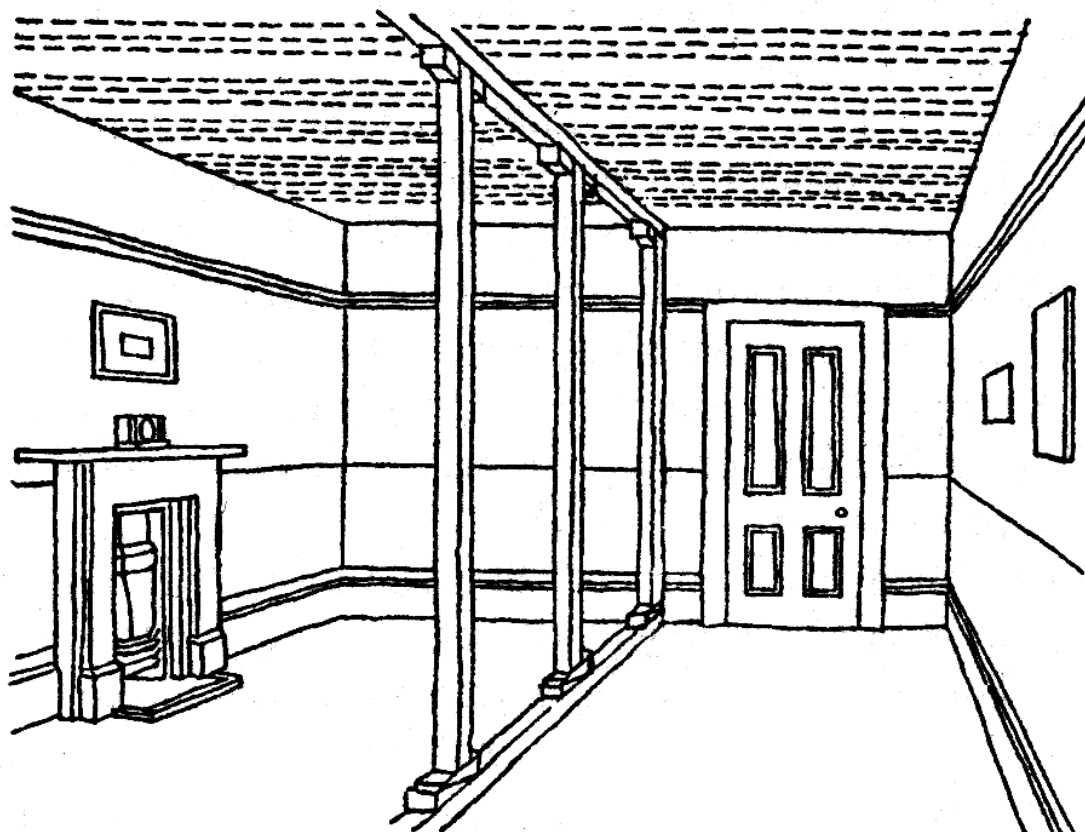


In a house with only two floors and without a cellar, choose a room on the ground floor so that you have protection overhead

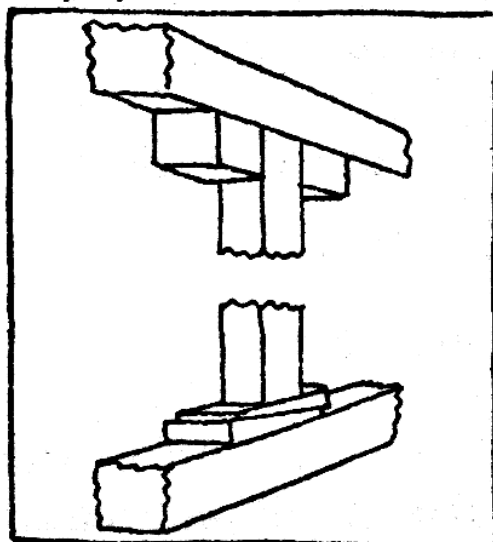
Strengthening the room

If your refuge-room is on the ground floor or in the basement, you can support the ceiling with wooden props as an additional protection. The illustration shows a way of doing this, but it would be best to take a builder's advice before setting to work. Stout posts or scaffold poles are placed upright, resting on a thick plank on the floor and supporting a stout piece of timber against the ceiling, at right angles to the ceiling joists, i.e. in the same direction as the floor boards above.

*How
to support
a ceiling*



*The illustration
below
shows the
detail of
how to fix
the props*

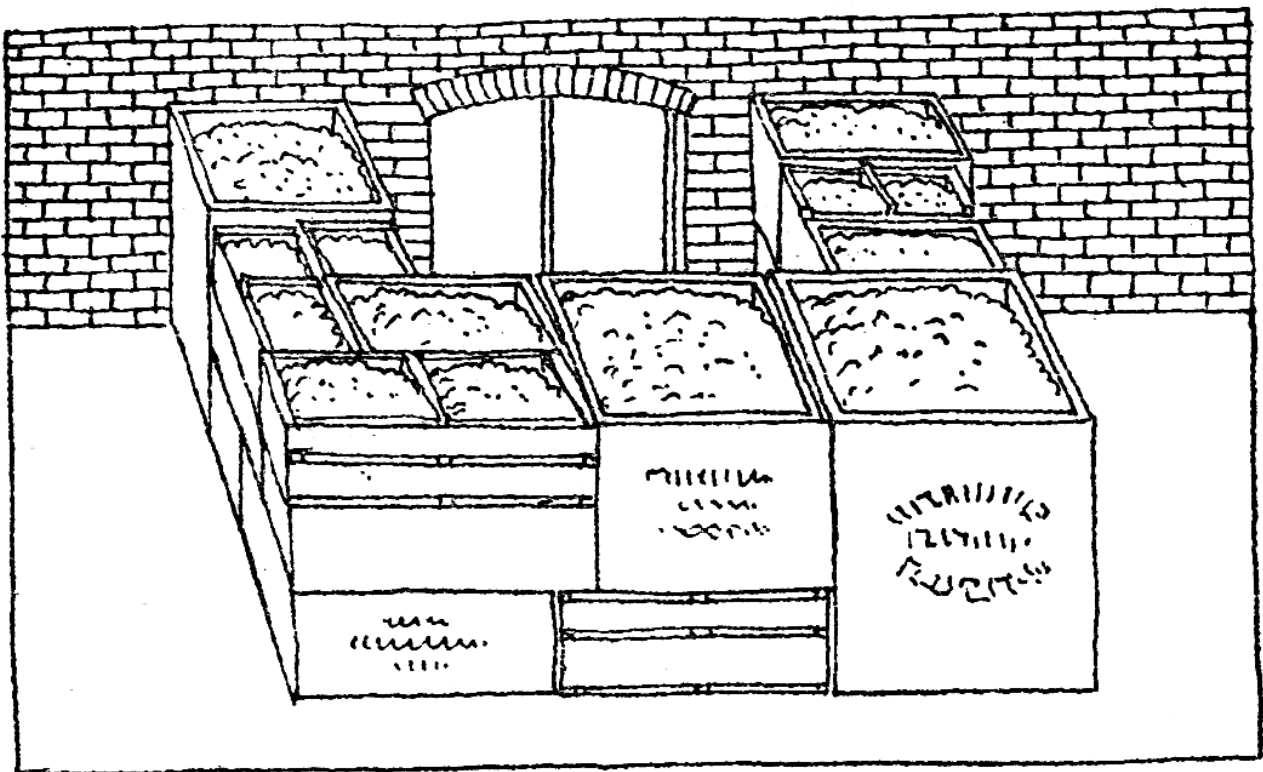


The smaller illustration shows how the posts are held in position at the top by two blocks of wood on the ceiling beam. The posts are forced tight by two wedges at the foot, driven in opposite ways. Do not drive these wedges too violently, otherwise you may lift the ceiling and damage it. If the floor of your refuge-room is solid, such as you might find in a basement, you will not need a plank across the whole floor, but only a piece of wood a foot or so long under each prop.

EXTRA PRECAUTIONS AGAINST EXPLOSIVE BOMBS

TRENCHES. Instead of having a refuge-room in your house, you can, if you have a garden, build a dug-out or a trench. A trench provides excellent protection against the effects of a bursting bomb, and is simple to construct. Full instructions will be given in another book which you will be able to buy. Your air raid wardens will also be able to advise.

SANDBAGS. Sandbags outside are the best protection if your walls are not thick enough to resist splinters. Do not rely on a wall keeping out splinters unless it is more than a foot thick. Sandbags are also the best protection for window openings. If you can completely close the window opening with a wall of sandbags you will prevent the glass being broken by the blast of an explosion, as well as keeping out splinters. But the window must still be sealed inside against gas.



A basement window protected by boxes of earth

Any bags or sacks, including paper sacks such as are used for cement, will do for sandbags. But if they are large, don't fill

MINISTRY OF



HOME SECURITY

1940

Air Raids

WHAT YOU MUST KNOW

WHAT YOU MUST DO

3d

Your Home as an Air Raid Shelter

ISSUED BY THE MINISTRY OF HOME SECURITY

This 3d. official pamphlet, comprising 24 pages with 11 illustrations, tells you how, with a few simple materials easily obtained, or readily available in most households, a refuge room can be made in any ordinary dwelling-house that will give almost as good protection as a steel or brick garden shelter.

3^D

ON SALE AT EVERY POST OFFICE,
ORDER IT FROM ANY NEWSAGENT
Or send 4d. in stamps to the address below.

LONDON. PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE. 1940
To be purchased from H.M. Stationery Office at the following addresses:
York House, Kingsway, London, W.C.2; 120 George Street, Edinburgh 2;
26 York Street, Manchester 1; 1 St. Andrew's Crescent, Cardiff;
80 Chichester Street, Belfast; or through any bookseller



MINISTRY OF HOME SECURITY

AIR RAIDS

What You must know

What You must do

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LONDON: H. M. STATIONERY OFFICE

Price 3d. Net or 10s. for 50.

FOREWORD

BY

SIR JOHN ANDERSON, G.C.B., G.C.S.I., G.C.I.E., M.P.
Minister of Home Security.

This book is written to help you and your family and your friends.

There has been built up in the last few years a vast organisation for Civil Defence; and, thanks to the devotion of a great army of volunteers, the services which it comprises have been welded into a highly efficient force. This organisation is briefly described in the first chapter, which has been included in this book for two reasons; first, because I may, in the near future, have to call on many of you to give some part of your time to one or other of these services, and secondly, because you may need the help of the services and should therefore understand something about them.

But the Civil Defence services alone cannot protect you from the consequences of air raids. Your own protection and the protection of your family must, in large measure, depend on your taking certain necessary precautions. You can yourself do much to minimise risk to yourself and to those dependent on you.

A great deal of information has been collected as a result of experience gained in actual air raids, and from this and from research and experiment the basic principles on which the protection of life and limb and property depends have been worked out and are set down here for your guidance. They are simple to understand and easy to carry out; and if you will act on them you will be able to face the dangers of air raids with the sure conviction that you have done all in your power for the safety of those depending on you, and with the calmness and assurance that come from a knowledge of the way in which these dangers can be met. In this way you will be helping not only yourself, but the Nation, for it is through the strengthening of your powers of resistance that the people of this country will be enabled to defeat every attempt the enemy may make to weaken its morale and paralyse its war effort.

In this war every man and woman is in the front line. A soldier at the front who neglects the proper protection of his trench does more than endanger his own life; he weakens a portion of his country's defences and betrays the trust which has been placed in him. You, too, will have betrayed your trust if you neglect to take the steps which it is your responsibility to take for the protection of yourself and your family.

This is a contribution to the winning of final victory which you personally can make and which no one else can make for you. I am confident that you will make it.

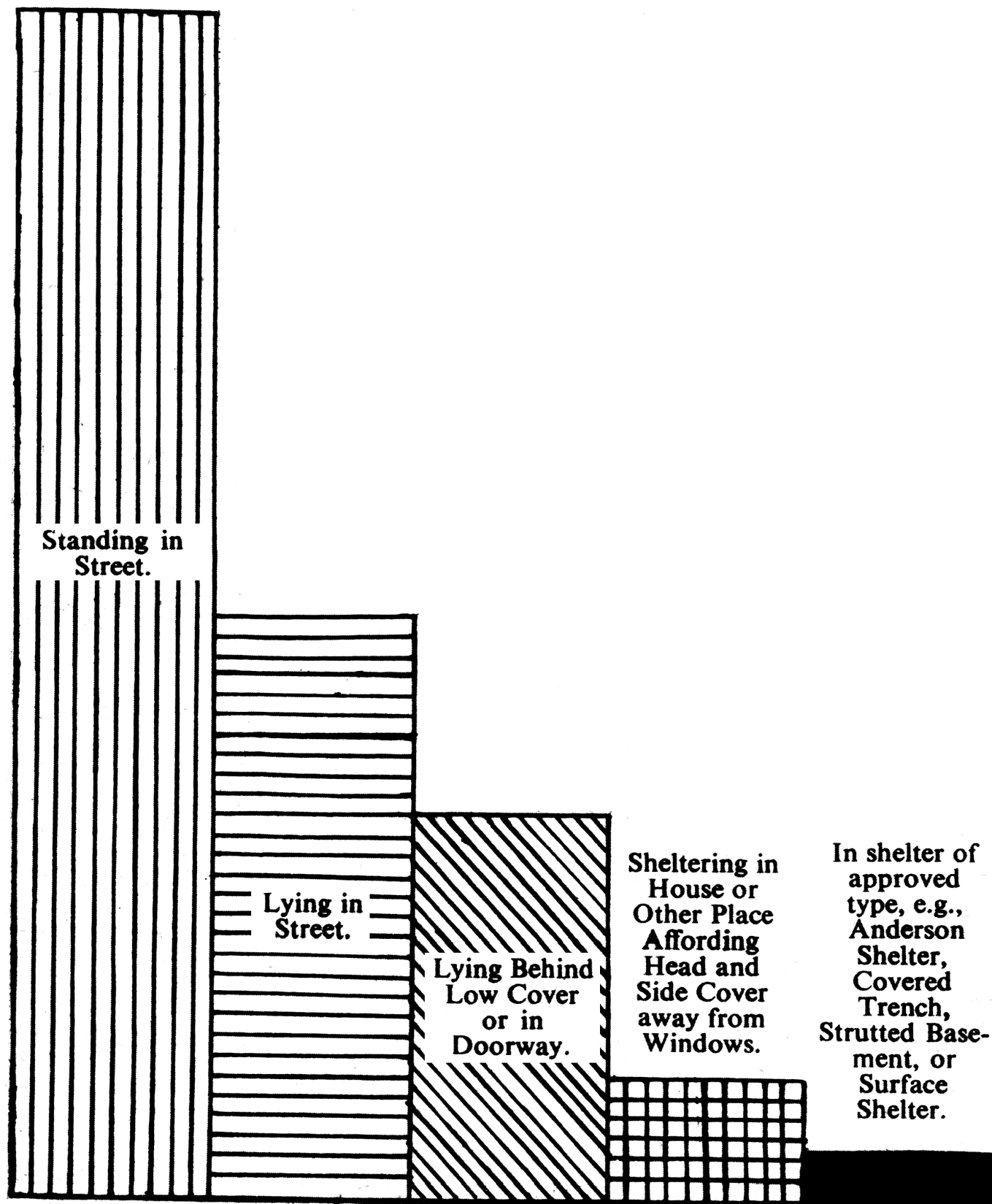


Ministry of Home Security.

June, 1940.

Tools.

A number of tools such as picks, shovels, and crowbars should be kept in a shelter to be used in forcing a way out if the occupants are trapped. When the accommodation is being fitted out, it should be discovered where the weakest part of the structure is, or where it would be most suitable to work, should it become necessary to break a way out. This position should be clearly marked for the benefit of all.



This diagram is based on a large number of reports of the results of recent air raids and is an approximate indication of the difference in the degree of risk resulting from taking cover in various ways.

CHAPTER 3.

INCENDIARY BOMBS.

Incendiary Bombs and Their Characteristics.

Incendiary Agents.

Many incendiary agents, such as petrol, thermite, phosphorus, and magnesium, have been used in war, but the most effective as a projectile is the Magnesium Bomb, which consists of a magnesium alloy exterior and a core of thermite priming composition.

The chief advantages of this type of bomb are that the whole of it is combustible with the exception of the striker mechanism and the sheet-iron tail fin, and that it remains active longer than most other forms of incendiary bomb of equal weight.

Incendiary Bomb Attack.

Generally speaking, the object of incendiary bomb attack from the air is to cause many fires over a large area at once. To do this each aircraft must carry as large a number as possible of the lightest bombs which will effectively start a fire; for this purpose the "kilo" or 2½-lb. magnesium bomb offers great advantages since a large bomber can carry 1,000 or more of these bombs.

They may be released in salvos of 10 or 20, and if 15 per cent. of the bombs dropped in a normally built-up area actually hit buildings, a reasonable proportion for such an area, and only half of these started fires, at least 75 fires could be caused by a single aircraft.

If there were 10 aircraft 750 fires might thus be started simultaneously.

Penetration and Protection.

The light incendiary bomb has been designed to penetrate any ordinary roof material, such as slate or tile, and to become lodged in upper storeys, where a fire may result. Unless the bomb enters through a window, it will probably be arrested by the first boarded floor below the roof, where it will start a fire and then, burning its way through the floor, start a further fire on the floor below.

To lessen this risk, it is important to remove inflammable materials in attic or roof spaces. In addition, to prolong the resistance of woodwork to burning, it is helpful to apply liberally on upper roof timbers in these spaces one of the many recognised flame-resisting paints or plasters in accordance with the directions of the manufacturer. It is not difficult, however, and it is certainly far cheaper, to buy the ingredients of such a composition and prepare the mixture at home. For those who may wish to do so, the formula is :—

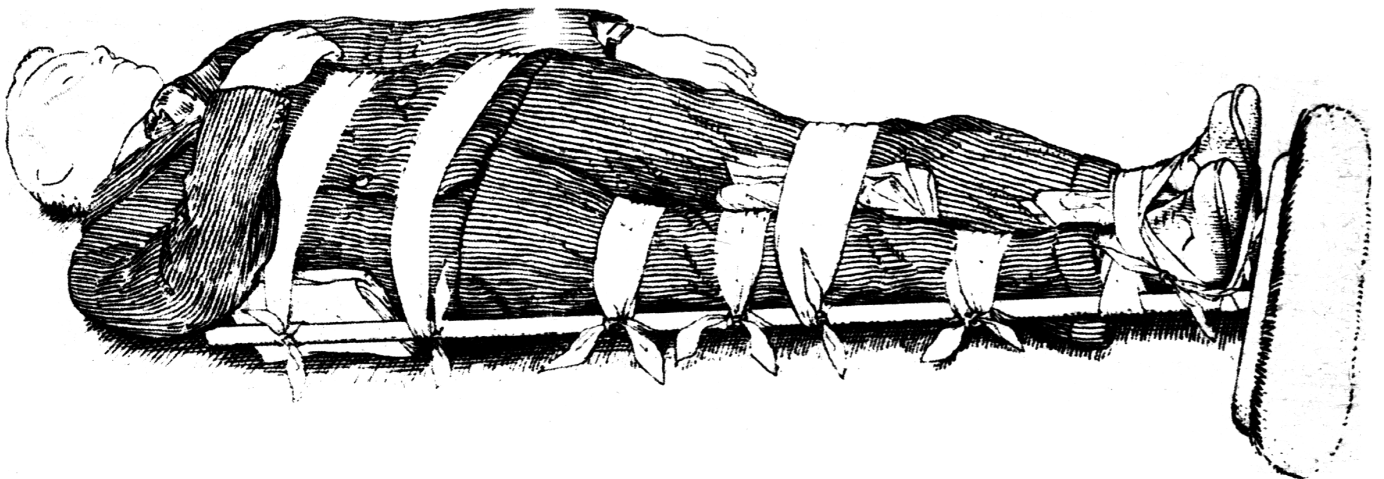
1½ lb. of Kaolin (china clay) to 1 lb. 2 oz. of sodium silicate in syrup form, mixed in 1 pint of water.

It should be understood that the application of flame-resisting paints and plasters do not prevent fire, but simply prolong the resistance of dry woodwork to burning, thus giving the fire-fighter more time to get to the bomb before

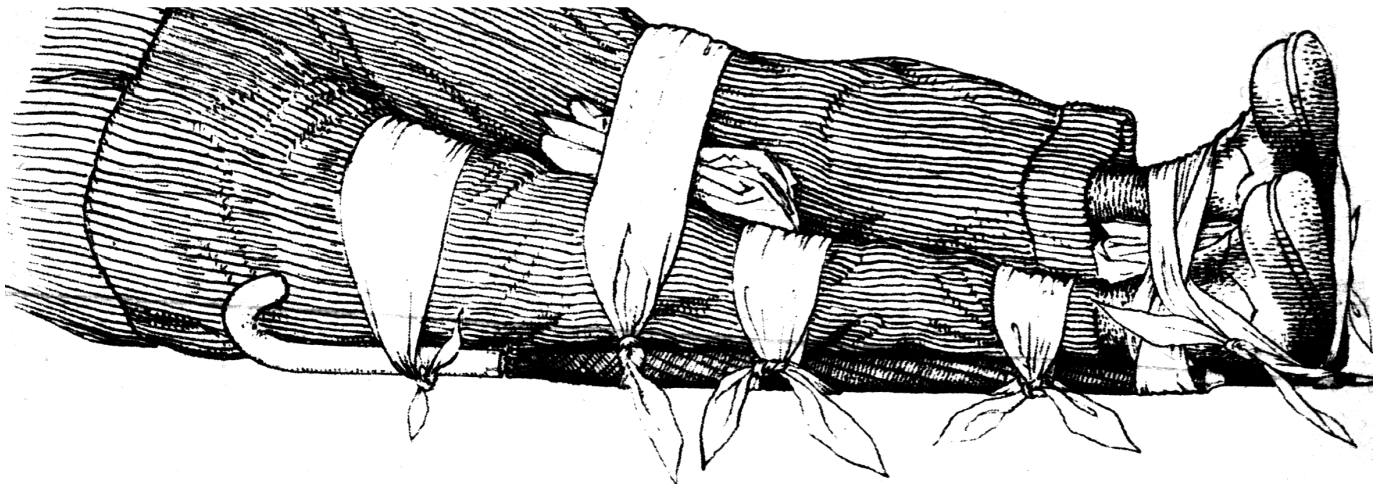
It may be convenient to sum up briefly some of the main guiding principles in elementary first aid :—

- (i) Severe bleeding should be attended to at the earliest possible moment. This does not mean that every cut or wound should have prior attention. Discrimination should be used : the rule applies to profuse bleeding, the continuance of which would endanger life.
- (ii) The casualty must be able to breathe normally : any cause of difficult breathing must be dealt with ; and artificial respiration, if needed, must be started promptly and maintained.
- (iii) In cases of gross injury to a limb, whether or not a fracture is recognised, and in all cases of injury involving joints, the affected part should be supported and secured by simple methods before the casualty is moved, unless for any reason his life is in danger.
- (iv) Any person who is, or has been, entrapped or buried under debris must be treated on the assumption that the severest crush injuries have been received. These might include fracture of the thigh, pelvis, or spine.

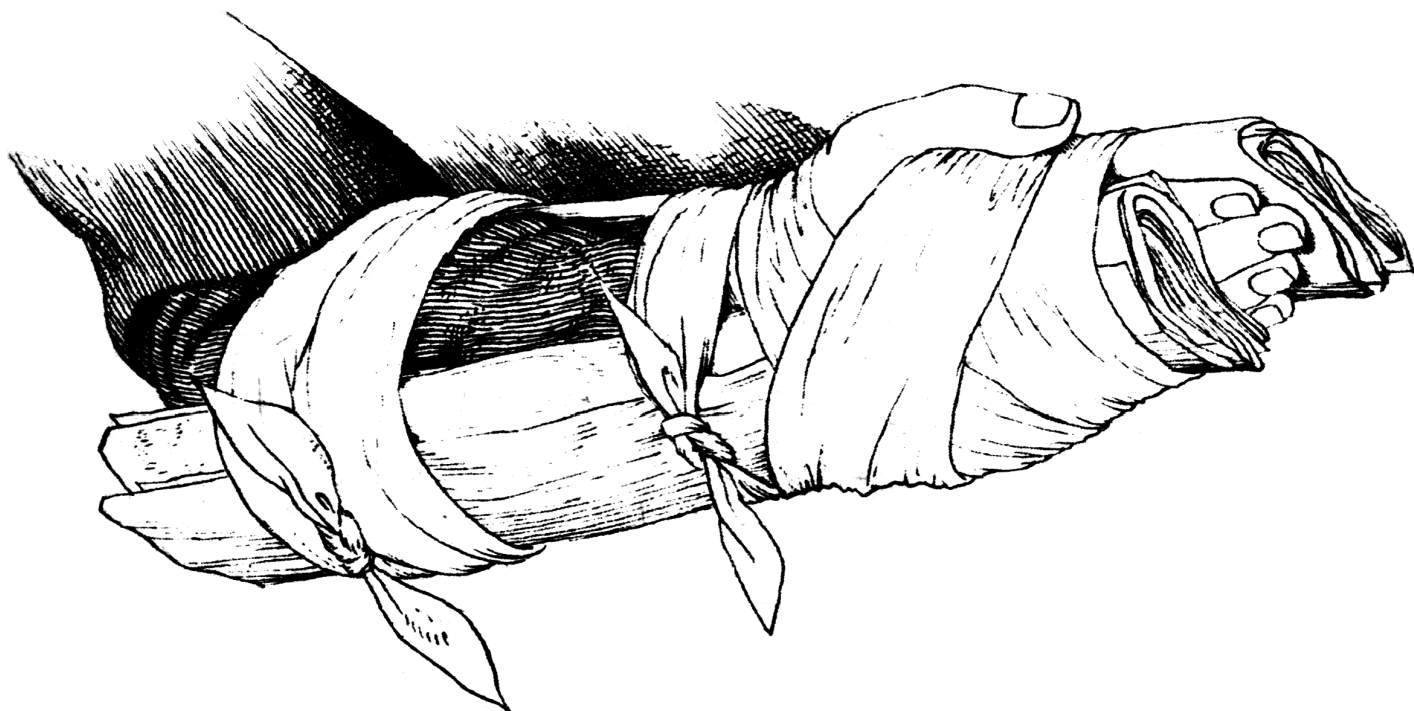
59



A broom used as a thigh splint by placing the handle along the injured limb, with the head of the broom at the feet. Loosely folded pieces of newspaper or other material may be used as padding, placed between the ankle and knee joints, and also at the hip.



Sketch II.—Simple fracture through middle third of tibia (shin-bone). The illustration shows an umbrella used as a splint. The ankles and knee joints are padded with loosely folded newspaper.



Sketch III. Simple fracture through one or both bones of the forearm.

The illustration shows the use of newspaper, folded to the approximate size of an arm splint, so as to be stiff enough to give rigid support.

APPENDIX

TABLE OF WAR GASES.

1. Properties.	2. Odour.	3. Effects Upon Human Body.
Mustard An oily liquid heavier than water, varying from dark brown to straw-yellow. May produce iridescent stain. Emits invisible gas. Liquid and gas have great powers of penetration.	Similar to garlic, onions, horse-radish or mustard. May be faint or pronounced.	Irritation producing inflammation in eyes and throat, possibly resulting in blindness and lung damage. Reddening and blistering of skin. Symptoms delayed, appearing from 2-8 hours or more after exposure.
Lewisite Colourless liquid when pure, but brown in crude state; heavier than water. Emits invisible gas. Liquid and gas have great powers of penetration. Contains arsenic.	Strong smell of geraniums.	Severe irritation to nose and damage to eyes and lungs, possibly with permanent effects. Reddening and blistering of skin. Effects noticed immediately.

IN AN AIR RAID . . .

IF YOU ARE CAUGHT IN THE STREET

Don't stand and stare
at the sky



1

Take cover at once



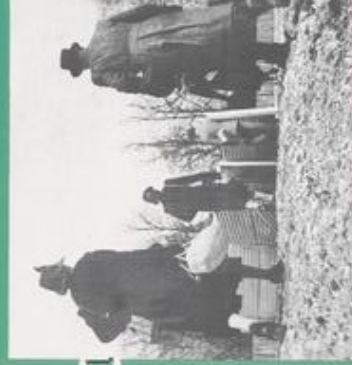
2

IN AN AIR RAID . . .

IF YOU ARE OUT OF DOORS

GET UNDER COVER AT ONCE

If in the open
with no cover
-lie down



1

If your home is within
5 minutes - go there



2

IN AN AIR RAID . . .

WHAT MOTORISTS MUST DO

BY DAY

- Park your car off the main highway, close to the kerb.
- Obey promptly any instructions from police or air raid wardens.
- Go to the nearest shelter, or take cover.



AT NIGHT

- Do the same as by day, but **SWITCH OFF YOUR HEADLAMP.** Leave rear and side lights on.



THE SURFACE SHELTER

THERE can be no *absolute* safety anywhere from enemy attack. The courageous British people realises this. But months of bombing have proved that surface shelters stand up to nearby bomb explosions very well indeed. Look at these photos, typical of many from all parts of the country. Time and time again well built surface shelters have kept their occupants safe even when surrounding buildings have been wrecked.

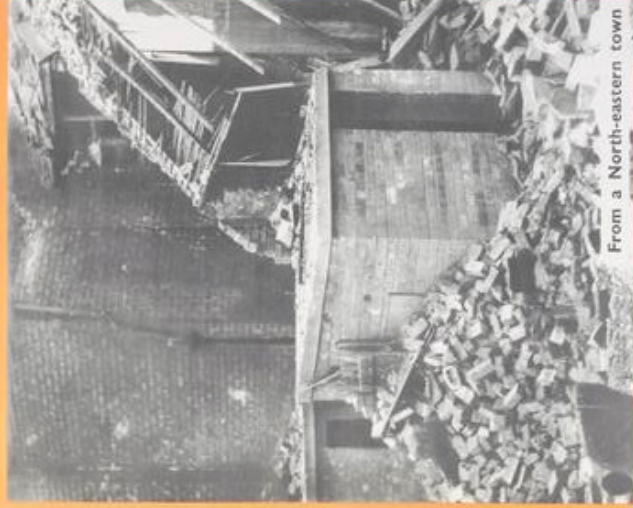


From a North-eastern town

STANDS UP TO IT WELL



From an East coast town



From a North-eastern town

City of Westminster.

AIR RAID SHELTERS

AT NIGHT





See the

BLUE LIGHT -

it means

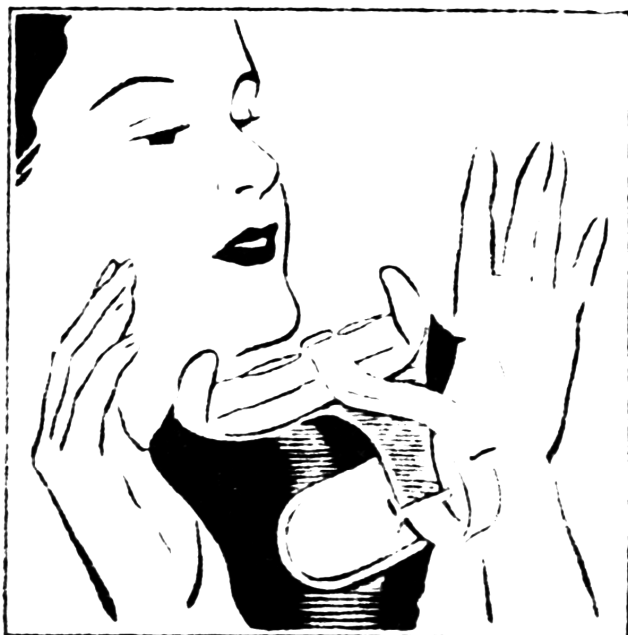
SHELTER at NIGHT

Issued by Westminster City Council A.R.P. Office Alhambra House, 31, Charing Cross Rd. W.C.2. (2th January 1940.)



**ALWAYS HAVE YOUR GAS MASK
WITH YOU — DAY AND NIGHT
LEARN TO PUT IT ON QUICKLY**

PRACTISE PUTTING ON YOUR GAS MASK



1. Hold your breath.
(To breathe in gas may be fatal.)
2. Hold mask in front of face, thumbs inside straps.
3. Thrust chin well forward into mask. Pull straps as far over head as they will go.
4. Run finger round face-piece taking care head-straps are not twisted.

MAKE SURE IT FITS

See that the rubber fits snugly at sides of jaw and under chin. The head-straps should be adjusted to hold the mask firmly. To test for fit, hold a piece of paper to end of mask and breathe in. The paper should stick.



Effectiveness of Some Civil Defense Actions in Protecting Urban Populations (u)

Appendix B of Defense of the US against Attack by Aircraft and Missiles (u)

ORO-R-17, Appendix B

ORO-R-17 (App B)

~~CONFIDENTIAL~~

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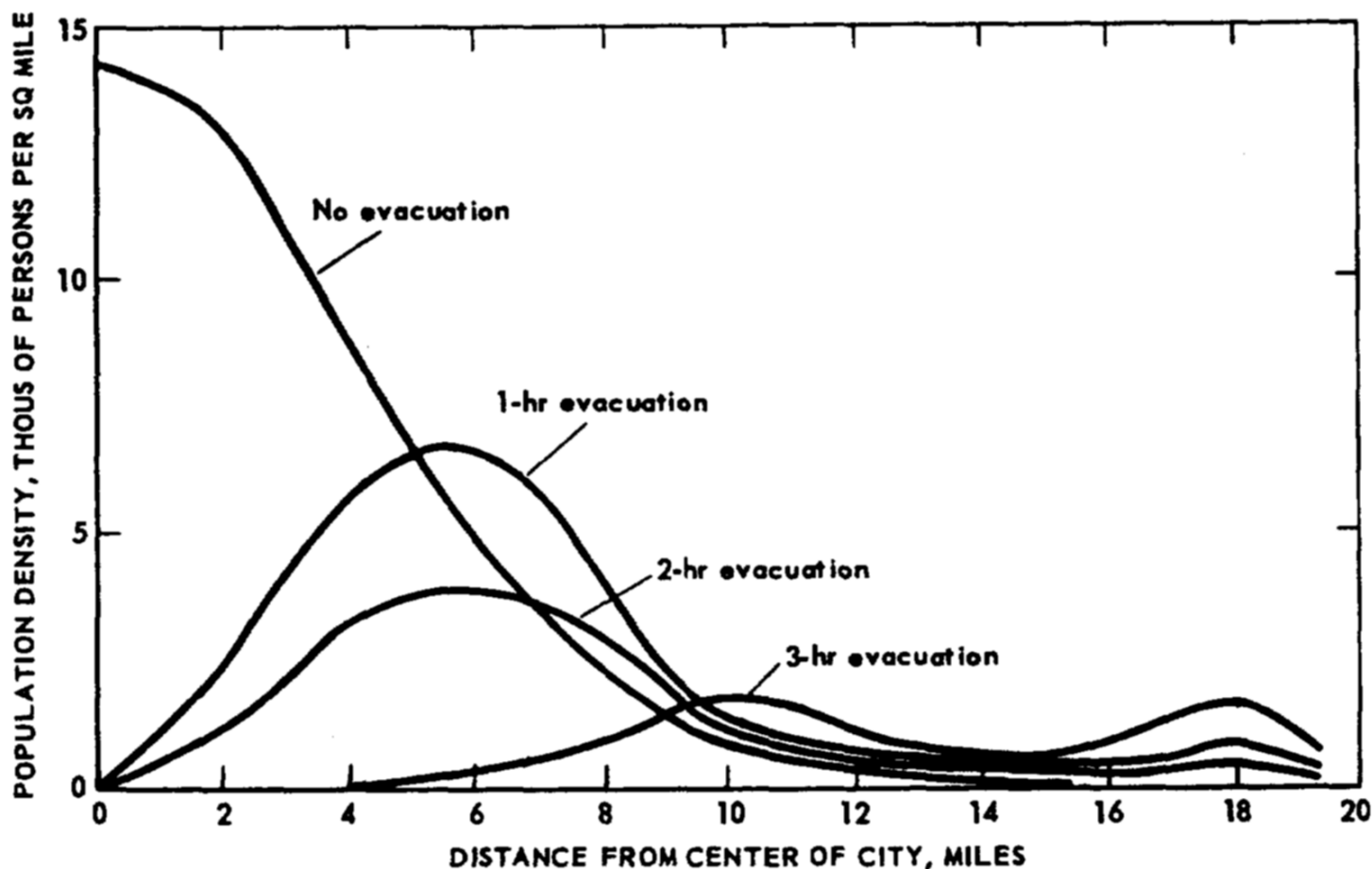


Fig. 10 — Population Density of Washington Target as Function of Distance from Center of City for Three Evacuation Times

NUMBER AND CLASSIFICATION OF OFFICIAL EVACUEES IN GREAT BRITAIN IN 1939 AND 1940

	SEPTEMBER, 1939		JANUARY, 1940
	Number	Percentage Distribu- tion	Number
900,000 of the 1.5 million returned to the target areas after four months of war.			
1. Unaccompanied school children.....	826,959	56.1	457,600
2. Mothers and accompanied children....	523,670	35.5	64,900
3. Expectant mothers.....	12,705	0.9	1,140
4. Blind persons, cripples, and other spe- cial classes.....	7,057	0.5	2,440
5. Teachers and helpers.....	103,000	7.0	46,500
Total.....	1,473,391	100.0	572,580
			39

Source: R. M. Titmuss, *Problems of Social Policy* (London: H.M. Stationery Office, 1950), pp. 103 and 172.

HEARINGS
BEFORE THE
JOINT COMMITTEE ON
DEFENSE PRODUCTION
CONGRESS OF THE UNITED STATES
NINETY-FOURTH CONGRESS
SECOND SESSION

APRIL 28, 1976

Printed for the use of the
Joint Committee on Defense Production



HEARING ON CIVIL PREPAREDNESS AND LIMITED NUCLEAR WAR

WEDNESDAY APRIL 28, 1976

U.S. SENATE AND
U.S. HOUSE OF REPRESENTATIVES,
JOINT COMMITTEE ON DEFENSE PRODUCTION,
Washington, D.C.

The committee met at 10:05 a.m. in room 5302, Dirksen Senate Office Building, Hon. William Proxmire, vice chairman of the subcommittee, presiding.

Present: Senators William Proxmire and John Sparkman.

Senator PROXMIRE. The committee will come to order.

Today's hearing inaugurates a review by the Joint Committee on our Nation's civil preparedness. It is the first such congressional review in over two decades.

By civil preparedness, we mean those mainly civilian measures by which we seek to protect the lives and property of our citizens.

This is the first function of any government. A government which cannot meet this fundamental test of defending its people and the national treasure is not likely to survive for very long.

In subsequent hearings, the committee will examine the adequacy of Federal, State, and local preparedness programs, including plans for fallout shelters, strategic evacuation, preparedness exercises and drills, civil defense stockpiles, and continuity of government. Likewise, the Joint Committee will inquire into the organization of the Government for preparedness. It will also review the Nation's industrial and economic preparedness in terms of the defense industrial base.

This is an especially timely undertaking. Over the past 2 years the United States has been moving from a declared nuclear policy of mutual assured destruction to one of flexible response, or limited nuclear war.

In the minds of some eminent strategists, this implies a lowering of the nuclear weapons threshold, a quickening of the trigger finger on the missile launch console, and an increased probability of uncontrolled nuclear conflict.

But to other equally qualified experts, this shift in strategic doctrine, this shift to larger numbers of more flexible, or more versatile and accurate weapons and control systems does not undermine deterrence of nuclear war; instead, it enhances deterrence.

Well, it can't be both ways and whenever you have such a complete divergence in expert opinion, it is time for a careful review of the facts.

These hearings are also timely in that there are increasing rumors of a civil defense gap, with the Soviet Union well in the lead.

In this year's annual report, Defense Secretary Rumsfeld stated that, and I quote:

An asymmetry has developed over the years that bears directly on our strategic relationship with the Soviets and on the credibility of our deterrent posture. For a number of years, the Soviets have devoted considerable resources to their civil defense effort which emphasizes the extensive evacuation of urban populations prior to the outbreak of hostilities, the construction of shelters in outlying areas, and compulsory training in civil defense for well over half the Soviet population. The importance the Soviets attach to this program at present is indicated not only by the resources they have been willing to incur in its support, but also by the appointment of a deputy minister of defense to head this effort.

Now, the term "asymmetry" used by the Secretary sounds to a non-expert like me like a four-bit word for "gap." We have heard a great deal over the years about gaps that never materialized or proved unimportant. Yet we have spent a lot of money to eliminate the non-existent or the insignificant. It is for this reason that the committee last week published the declassified text of the 1957 Gaither Report which invented the first missile gap.

3

**STATEMENT OF HON. PAUL NITZE, FORMER SECRETARY OF THE
NAVY, DEPUTY SECRETARY OF DEFENSE, AND MEMBER OF THE
SALT DELEGATION**

Mr. NITZE. Mr. Chairman, my interest in the questions which this committee is discussing began in 1944 when I was asked to be a director of the U.S. Strategic Bombing Survey. The required qualification of the directors was that they have no prior knowledge of military strategy or of air power, and could thus be presumed to be unbiased in appraising the effects of the immense U.S. strategic air effort in World War II. I spent the next 2 years in Europe and then in the Pacific in intensive work, in association with what I believe to have been the best talent available to this country, to try to understand something about both subjects. In the Pacific portion of the survey, as Vice Chairman, I was in effective command of the operation, including the detailed study of the effects of the weapons used at Hiroshima and Nagasaki.

Since that time much has changed. Weapons have increased in yield and missiles now have an intercontinental range. But these changes are hardly as revolutionary as the changes brought about by the role of effective air power in World War II and of the introduction of nuclear weapons in its closing phase. After all, the largest number of our nuclear reentry vehicles today are Poseidon warheads, each of which has an equivalent megatonnage less than twice that of the weapons used at Hiroshima and Nagasaki.

At Hiroshima and Nagasaki there was no air-raid warning and very few people availed themselves of the crude civil defense facilities which were available. Most of those that did, even at ground zero, in other words, directly under the explosion, which was at the optimum height of burst, survived. The trains were operating through Hiroshima 2 days after the explosion.

Let me paraphrase from an interchange I had in 1960 with Colonel Lincoln, head of the faculty at West Point, on this subject:

The Russians are careful students of Clausewitz. I do not believe they would ever ignore either the danger that a war once started might escalate to the full violence which the pure theory of war might indicate; on the other hand, they would never forget that war is a tool of policy and that every effort must be made to avoid letting it so escalate.¹

¹ In this connection the following quotation from *Communist of the Armed Forces* in November 1975 is pertinent: "The premise of Marxism-Leninism on war as a continuation of policy by military means remains true in an atmosphere of fundamental changes in military matters. The attempt of certain bourgeois ideologists to prove that nuclear missile weapons leave war outside the framework of policy and that nuclear war moves beyond the control of policy, ceases to be an instrument of policy and does not constitute its continuation is theoretically incorrect and politically reactionary."

On the other hand, I can well imagine that they might consider a controlled nuclear conflict in which significant military targets, but not urban-industrial targets, are the initial objects of attack, if they thought war unavoidable.

In conclusion, I would like to comment on this committee's print containing the Gaither Report of 1957.

I have now read that report for the first time in nearly 20 years. I am impressed—especially in light of the information then available to the Gaither committee—by the care and comprehensiveness of that committee's examination of the problems assigned to it for study. I note in contrast the cavalier imprecision reflected in the foreword prepared by this committee's staff.

It is not true that the Gaither Report ignored arms control, nor is it true that the report spoke of U.S. strategic inferiority as then a fact. To the contrary, the Gaither Report described the United States as then "capable of making a decisive attack on the U.S.S.R." In view of SAC's vulnerability "to a surprise attack in a period of lessened world tension," the Gaither Report also noted the U.S.S.R.'s capability to make "a very destructive attack on this country."

The report then observed, "As soon as SAC acquires an effective 'alert' status, the United States will be able to carry out a decisive attack even if surprised," and it anticipated that juncture "as the best time to negotiate from strength, since the U.S. military position vis-a-vis Russia might never be so strong again."

In attempting to disparage the Gaither committee's analysis, the staff foreword cites a subsequent estimate "* * * that at the time of the Gaither Report the Soviet Union probably had fewer than a dozen operational ICBMs." In fact, at the time of the Gaither Report—only a few weeks after the sputnik launching—the Soviet Union obviously had no operational ICBMs. The Gaither Report made no assumption to the contrary. Indeed, it postulated 1959 as the probable year the Soviet Union would first have operational ICBMs; in fact, they first became operational in 1960. What was crucial at the time was not only the question of how many ICBMs would be operational when, but even more importantly the question of the speed with which the U.S. Air Force could achieve adequate early warning facilities and an appropriate alert posture.

The Gaither Report focused attention on those questions.

Mr. Chairman: My interest in the questions which this Committee is discussing began in 1944 when I was asked to be a director of the U.S. Strategic Bombing Survey. The required qualification of the directors was that they have no prior knowledge of military strategy or of air power, and could thus be presumed to be unbiased in appraising the effects of the immense U.S. strategic air effort in World War II. I spent the next two years in Europe and then in the Pacific in intensive work, in association with what I believe to have been the best talent available to this country, to try to understand something about both subjects. In the Pacific portion of the Survey, as Vice Chairman I was in effective command of the operation, including the detailed study of the effects of the weapons used at Hiroshima and Nagasaki.

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8

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I believe they will always pay close attention to the interrelationship of the offense and the defense and not ignore either side of the equation. I cannot believe they would so ignore the military core of war as to consider the type of controlled nuclear conflict discussed in some of the papers circulated by the Committee's staff where military targets are avoided and industrial targets are hit. On the other hand, I can well imagine that they might consider a controlled nuclear conflict in which significant military targets, but not urban-industrial targets, are the initial objects of attack, if they thought war unavoidable.

In conclusion, I would like to comment on this Committee's print containing the Gaither Report of 1957.

I have now read that Report for the first time in nearly twenty years. I am impressed—especially in light of the information then available to the Gaither Committee—by the care and comprehensiveness of that Committee's examination of the problems assigned to it for study. I note in contrast the cavalier imprecision reflected in the foreword prepared by this Committee's staff.

It is not true that the Gaither Report ignored arms control, nor is it true that the report spoke of U.S. strategic inferiority as then a fact. To the contrary, the Gaither Report described the U.S. as then "capable of making a decisive attack on the USSR." In view of SAC's vulnerability "to a surprise attack in a period of lessened world tension," the Gaither Report also noted the USSR's capability to make "a very destructive attack on this country." The Report then observed, "As soon as SAC acquires an effective 'alert' status, the United States will be able to carry out a decisive attack even if surprised," and it anticipated that juncture as "the best time to negotiate from strength, since the U.S. military position vis-a-vis Russia might never be so strong again."

In attempting to disparage the Gaither Committee's analysis, the staff foreword cites a subsequent estimate "* * * that at the time of the Gaither Report the Soviet Union probably had fewer than a dozen operational ICBMs." In fact, at the time of the Gaither Report—only a few weeks after the Sputnik launching—the Soviet Union obviously had no operational ICBMs. The Gaither Report

made no assumption to the contrary. Indeed, it postulated 1959 as the probable year the Soviet Union would first have operational ICBMs; in fact, they first became operational in 1960. What was crucial at the time was not only the question of how many ICBMs would be operational when, but even more importantly the question of the speed with which the Air Force could achieve adequate early warning facilities and an appropriate alert posture.

The Gaither Report focused attention on those questions. Thereby the Report became a factor in stimulating an enormous effort on the part of the U.S. to move ahead with pertinent strategic programs. In those years the rate of expenditure on strategic programs was, allowing for inflation, about two and a half times the present rate. For all the great expense, the program was a bargain when considered against the calamitous potential consequences of permitting the strategic relationship to become unstable to the detriment of U.S. security and with increased risk to the maintenance of peace.

The Report placed first priority on the military measures necessary to maintain strategic stability and high quality deterrence. It placed a lower priority on those measures necessary to ensure survivability of the population in event deterrence were to fail. The two classes of measures are, however, interrelated.

STATEMENT OF HERMAN KAHN, DIRECTOR, HUDSON INSTITUTE

Senator PROXMIRE. Mr. Kahn.

Mr. KAHN. It is customary to start one's testimony with a statement of qualifications. Let me instead start with a disqualification.

I haven't really been spending very much time in the military field since 1965, but I started to go back last year, and I am now in the middle of reacquainting myself with the issues.

I might say though that comparing today's discussion to the sixties, there has been very little substantial improvement. In fact there have been some retrogressions. This both disturbs and surprises me.

Let me start by agreeing with Paul on two issues. The chairman just stated we can't have both increased and decreased deterrence. I believe that there are many measures which can go in both directions.

There are many measures which increase deterrence in one scenario or context, and decrease deterrence in another scenario or context. In particular, if one focuses on this abstract war, what Paul referred to as a pure military war, or a surprise attack out of the blue directed against civilians, then it is terribly easy to do many things which will decrease that deterrence.

But since I tend to feel we have, relatively speaking, too much deterrence of this situation I do not object to decreasing the deterrence of surprise attack out of the blue in favor of increasing deterrence in other situations. In fact there has been much too much attention to this simple situation. I know back in 1960, a number of polls were taken by Tom Schelling, by Weapon Systems Evaluation Group (WSEG) and others. In these polls analysts were asked "If a war occurred, what scenario do you think would have preceded the war?"

Almost universally, they agreed there would have been a very tense situation, say bombs bursting in Europe, and then either an attack by the Soviets because they got into serious trouble, an accidental war, or an attack by the U.S. All the analysts agreed that a surprise attack out of the blue, directed at cities, was far and away the least probable way that a war was likely to start.

And yet they all also agreed that 90 percent of their personal studies and effort went to that case and the other 10 percent or so went into a study of a surprise attack out of the blue which hit military bases. In other words, the analysts agreed, that even though they were able

to choose their own subjects of study, they were spending almost all of their time on scenarios which, in their judgment, were not probable or important. They simply were the easiest things to study and talk about.

[Additional remarks:]

Many analysts are still doing this, but do not seem to know that this emphasis distorts the realistic priorities.

Now, when we looked at civil defense in 1960—or today—it was really almost impossible to protect the population against a surprise attack directed against them. We found that it was also impossible to protect an economic base for massive war production against a surprise attack directed against the economic base.

Therefore, we did not ask ourselves, as a high priority, what does civil defense do for these objectives in these scenarios.

However we did not stop there. We went on to ask ourselves if there were any other roles for civil defense.

It seemed to us that there were a large number of roles. All of them tended to be second or third priority but still terribly important. When people said, "But that doesn't do any good in the first priority situation," we answered, "We don't care."

The first, perhaps the most important role, is to protect people when they are not targets. I am prepared to believe that doing this decreases deterrence, but I am willing to do it anyway.

I know when I examine the problem of attacking the Soviet Union that I want to preserve Moscow and Leningrad, my two biggest assets, and anything they do to make Moscow and Leningrad safe from becoming bonus targets improves my ability to plan war against the Soviets. Moscow and Leningrad are important to the Soviets and they are probably willing to do that. Deterrence is not the sole objective of policy.

In a book called *On Thermonuclear War* which I published in 1960, we mentioned what we called the Doomsday Machine was the highest possible deterrent, yet nobody wanted it. I might also mention that I made clear, in that book, that we didn't think there was any missile gap. In fact, just to go back over a little history of that, most people's recollection of the debate of that period tends to be wrong.

It is not true that the Democrats raised the issue of a missile gap against the Republican administration. That was a Republican statement. The Republicans predicted the Russians would have 300 missiles by 1960. But at the same time, the Republican administration said this wouldn't make any difference, because we had 2,000 bombers and they were more important than 300 missiles.

The great contribution of the Gaither Report, as Paul just said, was to make clear that if the Soviets had 300 missiles and we did not have any kind of warning system, then we might not have 2,000 bombers, because they could be destroyed by a surprise attack while still on the ground.

I also made clear, that while the Soviets probably would not have 300 operational missiles in 1960, if they did have them, we would be in trouble—that is, despite the predictions by the Republican administration we did not think they had such a force—but we were not sure.

What does one do when the other side may be able to do something in the near future and if one waits until he is certain before reacting, it is too late, while if one reacts early it may turn out to have been unnecessary?

Let me also make a remark about a release I saw from this committee which listed a series of predicted gaps which did not occur. In at least half the cases, people were rather clear that the gap might not occur, but they were not sure.

[Additional remarks:]

But they felt they had to worry about it ahead of time and even make some preparations because they could not afford to wait until all the facts were in.

Let me ask a question: What do you do if the other side exhibits a weapon system and has the production capability? You are not quite sure what he is going to do. Do you wait until he does it or do you worry about it?

In general this is a very complicated issue. In some cases, we almost have to make preparations ahead of time, even though they may be wasted. In other cases, we should wait until we are more sure; in still other cases, one just hopes for luck. But one should not, in my judgment, downgrade responsible officials who get concerned under such circumstances.

I might also draw attention to some studies done by Albert Wohlstetter. It is pointed out in these studies that in most cases, we have underestimated rather than overestimated U.S.S.R. future capability. I will ask that this report be sent to the committee.

If you look at the record, there has been more a problem of underestimation than overestimation. This is true in terms of the number of missiles the Soviets have had over time and in terms of Soviet capability on all kinds of other issues. We tend to remember the discussion when some hysterical people overstate the problem; then it turns out to be wrong. I would argue this is not at all the characteristic problem.

Let me turn to the major point I wanted to make today. I would argue that the scenario I worry about as the most probable scenario, is also the scenario which is least discussed. This is the case where there is opportunity for significant or even all-out mobilization before major thermonuclear attacks against the cities occur.

There are two recent and useful historical examples which illustrate this concept, the Korean War and World War II.

In June 1950, Congress was debating whether the budget should be \$15, \$16 or \$17 billion. The previous year it had been \$13 billion. A number of distinguished witnesses testified that \$18 billion would strain the economy, but \$16 billion was all right. North Korea marched on South Korea, and within 1 year, Congress authorized \$60 billion, an increase by a factor of 4.

This was totally unexpected and totally changed the strategic problem. One should note that it would not have been possible to fit into even an \$18 billion budget hardly any of the weapons systems we have procured since World War II. One could not have bought a Sage system, a B-47 system, a B-52 system, a Nike Hercules system, a Polaris system, and so on. None of these systems would have been feasible at the \$5 or \$6 billion budgets per service which were, roughly, current at that time.

As a result of this authorization, the Air Force budget was increased by about a factor of 5. The other two services had an increase of about 3. As a result, a whole new range of possibilities opened up for the services.

I can easily envisage a scenario for crisis in the future which involves military budgets of \$500 billion or more. That would change, if you will, the whole character of strategic planning. I do not expect any such situations to arise with high probability, but I do not consider it paranoia or unwise to prepare for such situations.

Probably an even better prototype for the situation we are thinking about is pre-World War II. After World War I, much of the world became sick of war, and war became "unthinkable" to most people, particularly in the victorious "Allied Powers." Strategists and publicists talked about poison gas and knock-out blows; they thought all the capital cities would be destroyed by poison gas in the first few days of a war. They did not understand the idea of limitations in warfare—of mutual deterrence even after hostilities have broken out.

When Hitler got elected in 1933, people became interested in larger defense budgets. Then he marched into the Rhineland and, of course, defense budgets increased slightly. Then there was the Anschluss and then Munich, and more substantial increases in military budgets. With the invasion of Czechoslovakia, everybody got deeply concerned. Then, finally, there was the invasion of Poland, the formal declaration of war and then 7 months of more or less "phony war." As a result there was opportunity on both sides for 7 months' of full-time war production, before the war really opened up.

We would argue that similar possibilities should be considered today. Nobody is interested in jumping into a nuclear war today. Nobody is going to want to execute the usual picture of nuclear war, in which each side presses every button and goes home. It is extraordinarily difficult to believe such a scenario.

It might happen. But I would be willing to bet, if this were a betting matter, 50 to 1 against it.

On the other hand, the situation might arise in which there was a declaration of war, followed by a phony war, or a serious confrontation in which there were credible threats of war. By the way, in such a confrontation, the following dialog tends to occur.

Both sides are saying to the other side, "There is absolutely nothing at risk which justifies this terrible danger to which we are subjecting each other and the rest of the world. It is clear that whatever we are arguing about is simply not worth the risk of a thermonuclear war. Therefore, one of us has to be reasonable—and it isn't going to be me."

That is, by the way, a terribly persuasive argument.

At this point, each side is trying to explain why the other side should be reasonable. You don't have to have a great defense to do that. All you have to be able to do is say, "I believe my defense establishment is better than yours, in important ways."

I can imagine the Russians telling us, "You are telling us the money we spent on our defense establishment does us no good, but we spent it because we thought it does do good. We believe that this defense establishment of ours works. You don't, but we believe it does."

If you can get that point across, you are going to put great pressure on the other side to back down.

Senator PROXMIRE. Very strong chance of what? I missed that.

Mr. KAHN. If we believe that they believe they have confidence in their establishment, we are going to back down, whether or not their

confidence is justified, because we would be destroyed almost as much as a result of their mistaken belief as by a correct one. If the other man can give you a credible picture, that he believes he has a serious edge over you, then even if he does not objectively have that edge, you may be in trouble.

That is even more true for allies. If they think the other side believes it has an edge, the allies are going to hedge. Finally it is even more true for neutrals that in a bargaining situation the strategic balance is very complex (which should be an obvious point) and the outsider is likely to be excessively influenced by appearances. Who strikes first and how many are dead in each city are almost irrelevant to many of these issues.

Finally, a last point. When we write scenarios for nuclear war, we find it difficult to write a credible scenario which doesn't involve months or weeks of warning. I would guess we are as good at writing scenarios as anybody in the world. We have certainly written as many.

I want to warn the committee, on the other hand, that when we looked at World War I, we didn't find that scenario plausible. The mere fact we can't write a plausible scenario for a war doesn't mean it can't occur, because one can find historical examples to the contrary.

Nevertheless, every scenario we write for nuclear war involves days, weeks or months of tension. Evacuation, last moment mobilizations are extraordinarily possible. By the way, evacuations occur not as a result of secret intelligence or in any attempt to try to outrun the missiles or the bombers. The *New York Times* and the *Washington Post* provide the warning perhaps days before the attack. People or governments then get frightened and decide to decrease their vulnerability to attack. The idea is, can you exploit such warning if it is printed in the papers?

[Complete statement follows:]

SUMMARY PAPER AND BRIEFING NOTES ON THE POTENTIAL OF THE DEFENSE MOBILIZATION BASE CONCEPT BY HERMAN KAHN, WILLIAM BROWN, AND WILLIAM SCHNEIDER, JR.

This submission is the responsibility of the authors and is not to be construed as representing any official opinions of the Hudson Institute or any other associated individuals or agencies.

PREFATORY NOTE

The following paper represents a summary of studies developed by the staff and consultants of the Hudson Institute more or less continuously over the last fifteen years although naturally it focuses more intensively upon recent work—in particular, a summary of a report on the concept of mobilization warfare by Herman Kahn and William Schneider, Jr. Most of Hudson's program of civil defense and mobilization base studies has been accomplished under the direction of William Brown, Herman Kahn and William Schneider, Jr. and at least half the Institute's personnel have participated in one or more of them. This particular submission was prepared as a joint paper by the three people named above.

MOBILIZATION WARFARE

1. The concept of mobilization warfare

The notion of mobilization in a nuclear age has the appearance of a contradiction in terms when arrayed against the conventional concept of mobilization. Mobilization has in general, been associated with the redirection of national resources, both human and material away from traditional civilian pursuits to support a defense effort. To some extent, it has been possible to conceive of a limited mobilization of military forces and associated national resources to support

limited political objectives although the more traditional perception has been associated with a general mobilization of the entire industrial might and armed forces of a nation.

The possibility of intercontinental strategic nuclear attack made possible through the development of ICBM's, missile firing submarines, and long-range bombers have made the initiation and conclusion of a nuclear conflict appear to be a matter of hours or days, and certainly not more than a few weeks in duration, making the traditional notion of mobilization appear to be as archaic and obsolete as the forces and weapons that had been in the past, mobilized.

This study is intended to advance the concept that mobilization is an important component of strategic nuclear conflict, and, we will argue, is likely to be the prototype of any U.S.-Soviet nuclear conflict should such a conflict occur. The concept can be most simply characterized from the perspective of the following simple generalized scenario: During a period of intense political crisis between the U.S. and the Soviet Union, both sides fear that a nuclear war may actually occur. However, neither side is willing to risk the consequences of a nuclear war with the existing levels of forces and defenses (military and civilian). As a consequence, each of the parties attempts to develop on a frantic basis, a very large-scale effective nuclear offense and defense capability which is associated with genuine fears about the possibility of a general war. The period of mobilization during and after an intense political crisis characterizes what we describe as "mobilization warfare." It is warfare in the sense of an intense and bitter competition of an accelerated arms race, but without the certainty that direct military action will occur. A plausible outcome of this scenario is that the side which mobilizes most effectively within a relatively brief period of time (say six months to two years) can achieve a dominant position capable of inhibiting the diplomatic efforts of the other.

The notion of "mobilization warfare" is not restricted only to strategic nuclear warfare. It is also applicable, for example, to a U.S.-Soviet struggle in Europe in which an intense political crisis raises the specter of an outbreak of conventional warfare between the two nations without the expectation that such a conflict would lead to a strategic or tactical nuclear exchange.

Perhaps the closest parallel to mobilization warfare during the nuclear era arose as a consequence of the Korean war. The ominous character of Soviet foreign policy following World War II culminated in the Soviet sponsored attack of North Korean forces against the Republic of Korea. The direction in Soviet foreign policy after World War II was not offset by any rebuilding of U.S. military power which had been rapidly dismantled after the end of World War II. However, when the Soviets authorized the attack on Korea, the change in U.S. attitudes regarding preparedness for a U.S.-Soviet strategic nuclear contingency was electric. One measure of the character of this concern, a measure characteristic of a serious mobilization, was the decision of the Congress to increase annual defense expenditures from \$16 to the \$60 billion authorized after the outbreak of the Korean war. This vast increase in authorized expenditure made possible a set of strategic programs that were simply not feasible within the prior U.S. defense budget. The new authorization made possible the B-52, the B-47, the Polaris Program, and Atlas Program and a host of related technological initiatives whose consequences are still influencing the shape of the U.S. strategic program today. It also developed a reasonable (for the time) civil defense program designed to move the more vulnerable portions of the home population rapidly to safer areas. As a consequence of this enormous build-up of strategic nuclear capability arising out of the concern over a possible U.S.-Soviet nuclear conflict in the early 1950s, the United States achieved for more than a decade a stark nuclear superiority over the Soviets. This superiority was so vast that in retrospect it appears clear that the Soviets were almost totally deterred from attempts to exert military power in support of their diplomatic objectives throughout the late 1950s and early 1960s.

In the early 1950s the Soviets also attempted to develop a larger strategic program, but were much less successful than the United States. This form of mobilization warfare, we argue, is more likely to become a "standard" mode of nuclear conflict with the Soviet Union than the commonly anticipated mode, namely a large-scale exchange of nuclear weapons.

Perhaps the most significant difference between traditional mobilization concepts and the concept of "mobilization warfare" that is the focus of this paper is that in a modern mobilization, the adequacy of a period of mobilization may be "tested" only in the sense that it can affect the perceptions of an opponent without

a shot being exchanged. Moreover, the period of mobilization in the modern era might be considerably more compressed and complicated than any which we have experienced in this century. In a very practical sense, the mobilization of Germany and the allied powers before the first World War was a traditional process which extended over a period of many years, although the most intense efforts took place after the initiation of the conflict. Similarly, the German and Japanese pre-war mobilization of their forces occurred over many years. In both cases, a large-scale and protracted conflict followed. Under modern conditions, a nuclear conflict between major powers is likely to be short compared to previous conflicts or to any period of mobilization.

The concept of mobilization warfare in a nuclear era implies relatively short reaction times with the ability to deploy major offensive as well as active and passive defensive systems which may be extremely costly and complex by any prior standards. Under such circumstances, it is entirely plausible that the U.S. strategic budget alone could constitute an expenditure of several hundreds of billions of dollars per year. Expenditures at such huge levels make possible a very wide range of military and non-military defense systems that could not be seriously considered with recent strategic budgets—less than \$10 billion.

For example, potentially high grade missile defense systems employing lasers, particle beam technology and other advanced concepts for boost phase, mid-course, and terminal interception could, in principle, be procured under conditions of "mobilization warfare." The crucial determinants for acquiring such a capability lies in the prior research and development program and in proper institutional orientation toward a mobilization potential. The requirements of a "mobilization base" to support the notion of mobilization warfare is sufficiently different from the objectives of existing research and development needed to support current and near-term defense requirements that expenditures for a mobilization base should be partitioned from other R&D expenditures. The primary function of a mobilization base is to facilitate the shortening of lead times to procure highly effective strategic forces, active defenses, and civilian protection, should a decision to procure such a capability be made in a context that requires such a build-up be completed in an extraordinarily short period of time (short, that is, by the standards of recent experience). Under some circumstances, it is sufficient simply to have "paper plans" say, for the conversion of designated industrial potential from civilian to military uses. In other cases, where the requirements are more critical, and less easily adaptable to short-term changes, some limited development or prototyping may be necessary. In still other cases, particularly where the function is highly complex and likely to involve large numbers of both civilian and military personnel, such as an ABM or civil defense system, it may be necessary to conduct a limited deployment or field testing, and to develop the professional cadres who could support a vast expansion if and when circumstances require such expansion. The decision as to what elements of a potential U.S. strategic posture should be most extensively or rapidly developed would depend upon the contribution such efforts would make to reducing the lead times necessary to deploy the capability during a period of intense mobilization. The United States already possesses a substantial infrastructure for the rapid short-term expansion of U.S. strategic forces. With relatively modest expenditures, it should be possible to dramatically improve the ability of the United States to mobilize rapidly during an appropriate crisis to increase strategic nuclear forces, its active and passive defenses, and its general purpose forces without the protracted lead times that we have tended to become accustomed to over the past two decades.

2. A baseline mobilization warfare scenario

The implausibility of a U.S.-Soviet strategic nuclear exchange in recent politico-military circumstances has tended to obscure the fact that there are numerous possibilities for a major clash of interests between the superpowers; and consequently, for escalation.

The scenario proposed here arises out of the Achilles' heel of the Soviet Union, the behavior of their East European satellites, in this case, East Germany. Internal dissension develops beyond the control of the local and Soviet political and military leadership in East Germany to the point where large-scale border crossing into West Germany by deserting elements of East German armed forces involve the NATO nations. Unlike the standard escalation scenario where such events lead ultimately to a U.S.-Soviet nuclear exchange, the potential escalation, itself, becomes a force for restraint.

TYPICAL STRATEGIC MOBILIZATION SCENARIOS

Of the four scenarios given below, the first two are history, the third used to be the great fear of NATO, and the fourth is probably the great fear of the Warsaw Pact.

1. The "phony war," 1940 (5 months) :
 - (a) Pre-crisis arms competition (UK, France, Germany and the U.S.S.R.).
 - (b) A major series of political-military crisis—
 - Militarization of the Rhineland (1936) ;
 - Anschluss (Austria) (1938) ;
 - Sudeten crisis (1938-39) ;
 - War in Poland (1939).
 - (c) De-escalation and negotiation (antagonists began a rapid buildup fearing a resumption of full scale conflict).
2. Korea (1950-53) :
 - (a) Pre-war politico-military crises—
 - Soviet invasion of Iran (1946) ;
 - Soviet takeover of East European nations (1945-48) ;
 - Berlin blockade (1948) ;
 - Soviet intervention in Turkey and Greece ;
 - Soviet military buildup, post WW-II.
 - (b) Major turnabout in U.S. policy—
 - Factor of four increase in defense expenditures in 18 months ;
 - Massive emphasis on strategic preparedness, especially active defense.
3. Successful Soviet attack on W. Berlin and subsequent de-escalation.
4. Uprising in East Germany gets out of control and escalates.

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CHARACTERISTICS OF A SPECIAL MOBILIZATION SCENARIO: A FORMAL DECLARATION OF WAR BY THE U.S.

1. The declaration would have solemn and especially great significance for our enemies, allies, and neutrals.
2. The information transferred would have :
 - (a) Unambiguous factual content of great importance ;
 - (b) Undeniable implications and symbolism ;
 - (c) Highly uncertain interpretations or implications.
3. Its existence would preempt "ordinary" crisis negotiation and deny the stability of any recent *fait accompli*.
4. In some extreme crises it could be temporizing—a declaration is not a spasm response—and lead to deescalation of actual fighting.
5. But it implies a rapid response to any increased use of force.
6. It tends to force a decision by allies to cooperate actively.
7. It would justify many peripheral actions (blockades, interdiction, property confiscation, internment of hostile aliens, etc.).
8. It would tend to unify the national response—and increase defense spending enormously through mobilization.
9. It would convey the unambiguous message that a *formal* peace treaty will be required to settle all the important issues.

ROLE OF RESEARCH FOR MOBILIZING ACTIVE DEFENSES

1. Missile defense probably would be the most important and expensive effort.
 2. Lead-time reduction becomes extremely important.
 3. A program is required to facilitate rapid massive procurement of mutually reinforcing systems—
 - Boost phase interception ;
 - Mid course interception ;
 - Terminal interception.
 4. A capability may soon be needed to support a war in space.
 5. A capability is required for integration into other—high priority strategic mobilization programs—
 - Air defense ;
 - Civil defense.
- Major research objective: design systems which are highly effective, mutually supporting and which can be rapidly deployed at high levels of expenditure.

APPENDIX I

PAUL HENRY NITZE

In the spring of 1969, Paul Henry Nitze was appointed the representative of the Secretary of Defense to the United States Delegation to the Strategic Arms Limitation Talks with the Soviet Union; a position he held until June 1974, at which time he resigned.

Mr. Nitze resigned from his duties as Deputy Secretary of Defense on January 20, 1969, a position he had held since July 1, 1967, succeeding Cyrus R. Vance.

Mr. Nitze was serving as 57th Secretary of the Navy when he was nominated by former President Lyndon B. Johnson on June 10, 1967, to become Deputy Secretary of Defense. He was confirmed by the United States Senate on June 29, 1967.

The late President John F. Kennedy nominated Mr. Nitze to be Secretary of the Navy on October 14, 1963. At that time he was serving as Assistant Secretary of Defense (International Security Affairs), having assumed that position on January 29, 1961. He began his duties as Secretary of the Navy on November 29, 1963.

Graduated "cum laude" in 1928 from Harvard University, Mr. Nitze subsequently joined the New York investment banking firm of Dillon Read and Company. In 1941, he left his position as Vice President of that firm to become financial director of the Office of the Coordinator of Inter-American Affairs.

From 1942-1943, he was Chief of the Metals and Minerals Branch of the Board of Economic Warfare, until named as Director of Foreign Procurement and Development for the Foreign Economic Administration.

During the period 1944-1946, Mr. Nitze was Vice Chairman of the United States Strategic Bombing Survey. He was awarded the Medal of Merit by President Truman for service to the nation in this capacity.

For the next seven years, he served with the Department of State, beginning in the position of Deputy Director of the Office of International Trade Policy. In 1948, he was named Deputy to the Assistant Secretary of State for Economic Affairs. In August, 1949, he became Deputy Director of the State Department's Policy Planning Staff, and Director the following year.

Mr. Nitze left the federal government in 1953 to become President of the Foreign Service Educational Foundation in Washington, D.C., a position he held until January 1961.

Mr. Nitze is Chairman of the Advisory Council of The Johns Hopkins School of Advanced International Studies in Washington, D.C., and also serves on the Board of Trustees of the University. He holds memberships on the Board of Directors of Schrodgers, Inc., in New York, and Schrodgers, Ltd., in London, The American Security and Trust Company of Washington, D.C., Northwestern Mutual Life Mortgage and Realty Investors of Milwaukee, Wisconsin, and is Chairman of the Board of the Aspen Skiing Corporation.

HERMAN KAHN

Herman Kahn was born in Bayonne, New Jersey, in 1922. He received a B.A. from UCLA in 1945 and an M.S. in physics from the California Institute of Technology in 1948. He was associated with the Rand Corporation before becoming in 1961 the principal founder and director of the Hudson Institute, a research organization studying public policy issues, with headquarters in Croton-on-Hudson, N.Y. His international reputation as a strategic warfare analyst or, as the *New Republic* put it, one of "the prophets of strategic reality," is based on his work at the Institute and on his books: *On Thermonuclear War* (1960), *Thinking about the Unthinkable* (1962), *On Escalation* (1965 and, revised *Pelican*

STATEMENT OF E. P. WIGNER¹ FOR THE JOINT COMMITTEE ON DEFENSE PRODUCTION

¹Dr. Wigner is a Nobel Laureate and an emeritus professor of physics at Princeton University and has long been associated with civil defense issues. He edited a 1968 study *Who Speaks for Civil Defense?*

THE EFFECTIVENESS OF CIVIL DEFENSE

This writer became convinced of the possible effectiveness of civil defense measures when he served as a member of the General Advisory Committee to the U.S. Atomic Energy Commission.

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Are the U.S.S.R. and China the only countries with elaborate and well developed civil defense systems? No—most of the peace-loving countries also have such systems, based on blast shelters, and their yearly expenditures per person on such defense is about 15 times greater than ours. This has been, so far, about 40¢ per person a year. Incidentally, the Swiss civil defense repeats our President Kennedy's message: (Civil defense) "is insurance we trust, will never be needed"—its greatest accomplishment is, according to the Swiss, that it will *not* have to be used, that it will divert the aggressive instincts of possible opponents.

It is easy to conclude that an effective civil defense is not only desirable, it is also possible.

IS CIVIL DEFENSE NECESSARY?

What is the principal danger that threatens us in the present absence of an effective civil defense? It is the possibility of the U.S.S.R. evacuating its cities, dispersing their population, and then making demands on us, under the threat of a nuclear attack, approximating those made by Hitler or Czechoslovakia which led to the Munich pact. This left Czechoslovakia essentially defenseless.

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THE ARGUMENTS AGAINST CIVIL DEFENSE

The argument which we heard after the U.S.S.R. civil defense efforts became generally apparent was that our installation of protection for our people would only induce the U.S.S.R. to augment its aggressive capability. We now know that such augmentation took place even though we did not organize a vigorous civil defense effort. One of the two arguments we now hear, the civil defense is too expensive, seems almost ridiculous. If Switzerland, Sweden, etc., *even China*, can afford the more costly, the blast shelter method, we with the highest per capita national wealth, can also surely afford the defense of our people. The other argument, in the words of one of the most learned opponents of civil defense, S. Drell, is that it would lead to an "escalation of the apprehension from the mood of today, vis-a-vis the dangers of a nuclear exchange between the U.S. and the Soviet Union." Should the apprehension of the danger not be greater now, where we have no effective defense, than it would be when we have such defense? Or is it proposed that we should lull the common people into ignorance of the true situation? It is remarkable also that the U.S.S.R. is not criticised for fostering the "apprehension" of its own people. One must conclude that the varying arguments against civil defense have little validity.

A FEW PROPOSALS RELATED TO OUR DEFENSE

The first change I would advocate is to stop maintaining that a nuclear war would be the end of mankind. Such a statement may give the impression to an opponent that he can achieve anything by threatening with a nuclear war. After all, he would argue, the opponent (that is us) will make any sacrifice to avoid the "end of mankind". Hence, if he is threatened with extinction he will give in, particularly if the threat comes from a party which does not believe that the war precipitated by him will lead to the "end of mankind". Instead of such a blatantly incorrect statement, it would be better to subscribe to Chuykov's doctrine that "knowledge and the skillful use of modern protective measures" will make it possible to provide effective protection. At least, we could adhere to Kissinger's earlier (1957) statement: "While it (civil defense) cannot avert the traumatic effect of vast physical destruction, its efficient operation may make the difference between the survival of a society and its collapse."

The second measure which I consider to be urgent is to establish better contact with the people at large. This makes it desirable for DCPA to expand its staff by the employment of people who can establish a contact with the population at large, who can speak and write the truth convincingly. One of the functions of these advisors would be to help the high schools to give instruction on the nature of nuclear explosions and the defense against the effects of these. This is a subject which is foreign to most present high school teachers, and the advisor could and should help them to acquire the necessary knowledge. After all, the Federal Government now intends to support the local schools and can well suggest that these contribute to the protection of the country. The high school instruction on civil defense—obligatory in the U.S.S.R.—would be very useful since, after all, we learn best when we are young and we learn most non-elementary facts from our teachers. But even more generally, the establishment of a close contact between those who protect our freedom, and those whose freedom is protected, would be very desirable; and acquainting people at large with the methods and effectiveness of civil defense would provide an avenue toward this goal. It may not be easy to find people who know about the methods and effectiveness of civil defense and who are also able and interested in communicating this and much other knowledge to the people at large, but every effort should be made to find such people and support them.

The last suggestion I wish to make is that the DCPA budget should certainly not be cut. It should steadily be increased until, in a few years, it reaches the per capita level of other peace-loving and non-expansionist countries, such as Switzerland, Holland, Sweden, etc. For reasons given in the rest of my statement, this would be of decisive importance for maintaining a valid, widely endorsed, and vigorous defense effort for our country—and it would support all freedom-directed nations. Their independence does depend to a certain degree on our strength and our ability to stand up for them. The examples of Hungary, Czechoslovakia, Poland—to mention only a few—show that such independence does not come freely.

Let me end on a bit more hopeful tone which is, however, as sincere as was the rest of my statement. This is the hope that an effective civil defense may not only protect our country and our freedoms, but it may

also lead to a more true peace than the present one, which is based on the fear of destruction. I hope such a peace in which no rulers are tempted to increase their domains will come into being!

STATEMENT OF GERARD C. SMITH¹

I propose to discuss this morning some of the arms control implications of Vladivostok as well as certain related aspects of the current Defense budget submission.

I. THE VLADIVOSTOK ACCORD

At the start let me say that I put forward these ideas tentatively, not categorically. I question that anyone can speak with certainty about the slippery issues surrounding strategic arms and their control. I admit to a bias in favor of a very strong defense but I believe that arms control can also advance the security of the United States and the world whether or not there is some relaxation of tensions between the U.S. and the U.S.S.R.

The Vladivostok accord should not be judged in and of itself—but in connection with the limit on defensive systems (ABMs) agreed upon in 1972 and other American-Soviet agreements relating to arms control. It may help in judging the significance of Vladivostok to see that accord as part of a process that has been going on for more than five years. The general strategic dialog of the 1960s led to the specific SALT exchanges of 1969–72 at Helsinki, Vienna, Washington, and Moscow. Gradually the two sides developed somewhat better understanding of each other's strategic preoccupations. Concerns about accidental or miscalculated nuclear hostilities led to the first two SALT agreements in 1971—on measures to reduce the risk of outbreak of nuclear war and on measures to improve the Washington-Moscow direct communication link or "Hot Line." In 1972 there was the major breakthrough, the treaty limiting ABMs to two sites apiece, accompanied by the interim agreement to freeze offensive launches at the approximate levels of 1972. These were followed in 1973 by the Nixon-Brezhnev agreed principles for offensive arms limitation and in 1974 the ABM Treaty levels were reduced to one site apiece. At year's end the Vladivostok accord foreshadowed limitations on offensive systems which although of relatively short duration may be considered as a counterpart of the ABM Treaty. In judging this latest agreement one should consider the cumulative effect of the entire SALT process which hopefully can be considered as a preparatory stage for the natural next steps—reduction in offensive force levels which the sides are now committed to negotiate and some limitation on improvements in weapons characteristics. A total ban on ABM systems should also be reconsidered.

I would not favor interrupting the current Geneva negotiations by introducing a proposal for reductions. I do not believe that reductions are negotiable now. The Soviet position since 1968 has called for first a limitation and subsequently for reductions. When and if

¹ Mr. Smith is the former Director of the U.S. Arms Control and Disarmament Agency and chief U.S. representative in SALT I. He is now in private practice with the law firm of Wilmer, Cutler, and Pickering. His statement submitted to the Joint Committee was originally delivered to the Senate Foreign Relations Committee in April 1975.

(Gross exaggerations, assuming Nevada desert type terrain with no thermal shadows by city skylines, no duck and cover, no clothing and fraudulent blast effects data which ignores Hiroshima's evidence)

APPENDIX III

U.S. CIVILIAN NUCLEAR FATALITY ESTIMATES¹ FOR VARIOUS COUNTERFORCE ATTACK SCENARIOS

Type of attack	Assumptions	Estimated fatalities
Comprehensive attack:		
Case 1, 60 percent destruction of military targets.	1 optimum height of burst and 1 surface burst warhead per each of 1,054 ICBM silos; pattern attack of SAC bases: unspecified attack on 2 SSBN support bases; good shelter posture.	3, 200, 000
Case 2, 60 percent destruction of military targets.	2 optimum height of burst warheads per each of 1,054 ICBM silos; no pattern attack of SAC bases; unspecified attack on 2 SSBN support bases; poor shelter posture.	6, 700, 000
Case 3, 57-60 percent destruction of military targets.	2 surface burst warheads per each of 1,054 ICBM silos; pattern attack of SAC bases; unspecified attack on 2 SSBN support bases; very poor shelter posture.	16, 300, 000
ICBM only attack:		
Case 1.....	2 550 kt optimum height of burst warheads per each of 1,054 ICBM silos.	² 4, 000, 000
Case 2, 42 percent silo destruction.	1 550 kt surface burst and 1 550 kt optimum height of burst warhead per each of 1,054 ICBM silos.	5, 600, 000
Case 3, 80 percent silo destruction.	1 3 Mt surface burst and 1 3 Mt optimum height of burst warhead per each of 1,054 ICBM silos.	18, 300, 000
Case 4.....	2 3 Mt surface burst warheads per each of 1,054 ICBM silos.....	³ 20, 000, 000
Airlift attack:⁴		
Case 1.....	1 200 kt cruise missile warhead per each of 5 U.S. heavy airlift bases (Dover AFB, Del.; McGuire AFB, N.J.; Travis AFB, Calif.; Charleston AFB, S.C.; and McChord AFB, Wash.)	70, 000
Case 2.....	1 1.2 Mt SLBM per each of 5 U.S. heavy airlift bases.....	210, 000
Case 3.....	1 1.2 Mt SLBM per each of 5 U.S. heavy airlift bases uses offset targeting.	135, 000

¹ Department of Defense estimates as reported to the Senate Foreign Relations Committee, July 11, 1975, and published in "Analyses of Effects of Limited Nuclear War," pp. 12-24. Note that figures are fatalities only and not casualties and that attacks are restricted to military facilities (counterforce) rather than populated areas (countervalue). Shelter posture is a function of degree of hardening and the willingness of the population to use shelters.

² Under.

³ Circa.

⁴ Assumes allied victories in a European war supported by U.S. military airlift provide incentives for destruction of major American airlift centers.

Survival of the Relocated Population of the U.S. After a Nuclear Attack

FINAL REPORT • JUNE 1976 ORNL-5041

by

Carsten M. Haaland

Conrad V. Chester

Eugene P. Wigner

for

Defense Civil Preparedness Agency

Washington, D. C. 20301

OAK RIDGE NATIONAL LABORATORY

AD A 026362

SURVIVAL OF THE RELOCATED POPULATION
OF THE U.S. AFTER A NUCLEAR ATTACK

C. M. Haaland, C. V. Chester, and E. P. Wigner

ABSTRACT

The feasibility of continued survival after a hypothetical nuclear attack is evaluated for people relocated from high-risk areas during the crisis period before the attack. The attack consists of 6559 MT, of which 5951 MT are ground bursts, on military, industrial, and urban targets. Relocated people are assumed to be adequately protected from fallout radiation by shelters of various kinds. The major problems in the postattack situation will be the control of exposure to fallout radiation, and prevention of severe food shortages to several tens of millions of people. A reserve of several million additional dosimeters is recommended to provide control of radiation exposure. Written instructions should be provided with each on their use and the evaluation of the hazard. Adequate food reserve exists in the U.S. in the form of grain stocks, but a vigorous shipping program would have to be initiated within two or three weeks after the attack to avoid large scale starvation in some areas. If the attack occurred in June when crops on the average are the most vulnerable to fallout radiation, the crop yield could be reduced by about one-third to one-half, and the effects on crops of possible increased ultraviolet radiation resulting from ozone layer depletion by nuclear detonations may further increase the loss. About 80% of the U.S. crude refining capacity and nearly all oil pipelines would be either destroyed or inoperative during the first several weeks after an attack. However, a few billion gallons of diesel fuel and gasoline would survive in tank storage throughout the country, more than enough for trains and trucks to accomplish the grain shipments required for survival. Results of a computer program to minimize the ton-miles of shipments of grain between Business Economic Areas (BEAs) indicate that less than 2% of the 1970 rail shipping capacity, or less than 6% of the 1970 truck shipping capacity would be adequate to carry out the necessary grain shipments. The continuity of a strong federal government throughout the attack and postattack period is essential to coordinate the wide-scale interstate survival activities.

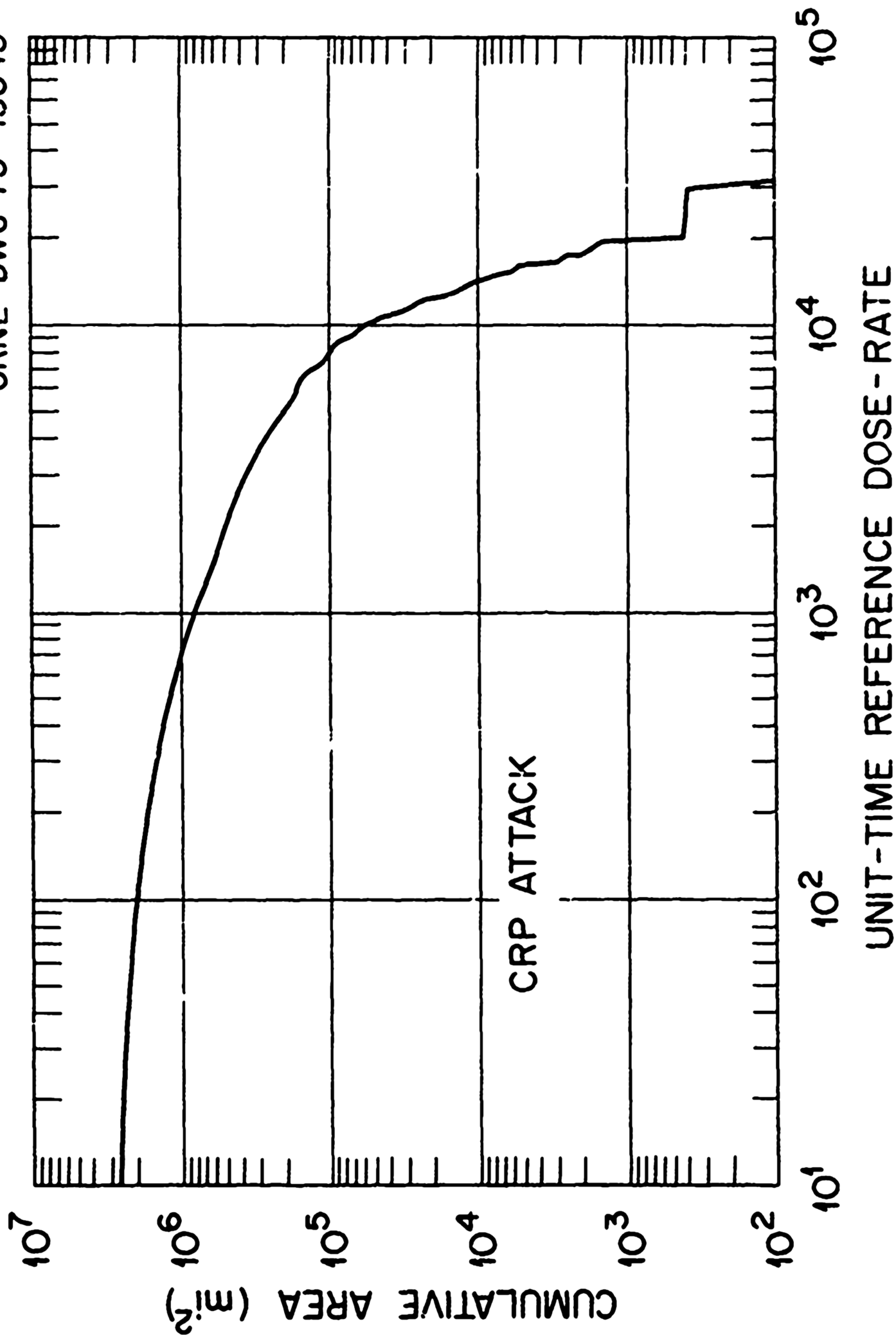


Fig. 4.2 Area of U.S. as a Function of Unit-Time Reference Dose-Rate.

THE WHITE HOUSE

WASHINGTON

#76

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July 25, 1980

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Presidential Directive/NSC-59

TO: The Vice President
The Secretary of Defense

ALSO: The Assistant to the President for
National Security Affairs
The Chairman, Joint Chiefs of Staff

SUBJECT: Nuclear Weapons Employment Policy (C)

In PD-18, I directed a follow-on study of our targeting policy for nuclear forces. I have reviewed the results and considered their implications for maintaining deterrence in the present decade, particularly in light of the growing Soviet strategic weapons arsenal and its capabilities. (S)

The most fundamental objective of our strategic policy remains nuclear deterrence. I reaffirm the directive of PD-18 to that effect. The purpose of this directive is to outline policies and actions in the nuclear force employment field to secure that continuing objective. (S)

Our strategic nuclear forces must be able to deter nuclear attacks not only on our own country but also on our forces overseas, as well as on our friends and allies, and to contribute to deterrence of non-nuclear attacks. To continue to deter in an era of strategic nuclear equivalence, it is necessary to have nuclear (as well as conventional) forces such that in considering aggression against our interests any adversary would recognize that no plausible outcome would represent a victory on any plausible definition of victory. To this end and so as to preserve the possibility of bargaining effectively to terminate the war on acceptable terms that are as favorable as practical, if deterrence fails initially, we must be capable of fighting successfully so that the adversary would not achieve his war aims and would suffer costs that are unacceptable, or in any event greater than his gains, from having initiated an attack. (C)

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Review on May 15, 2000

Reason for Extension: NSC 1.13(e)

Downgraded Per per 6/12/09 NSC Mr.Case 2008-085

DECLASSIFIED

Authority 6/12/09 LTR, 08-085
NARA 2 Date 7/24/12

The employment of nuclear forces must be effectively related to operations of our general purpose forces. Our doctrines for the use of forces in nuclear conflict must insure that we can pursue specific policy objectives selected by the National Command Authorities at that time, from general guidelines established in advance. (S)

These requirements form the broad outline of our evolving counter-vailing strategy. To meet these requirements, improvements should be made to our forces, their supporting C3 and intelligence, and their employment plans and planning apparatus, to achieve a high degree of flexibility, enduring survivability, and adequate performance in the face of enemy actions. The following principles and goals should guide your efforts in making these improvements. (S)

Pre-planned options. The Single Integrated Operational Plan will provide pre-planned targeting for strikes against the Soviet Union, its allies and its forces. It should provide for retaliatory strikes that will be effective, even if the Soviets attack first, without warning, and in a manner designed to reduce our capability as much as possible. It will be developed with flexible sub-options that will permit, to the extent that survival of C3 allows, sequential selection of attacks from among a full range of military targets, industrial targets providing immediate military support, and political control targets, while retaining a survivable and enduring capability that is sufficient to attack a broader set of urban and industrial targets. In addition, to the maximum extent possible, pre-planned options will be provided for selection in response to specific, lesser contingencies (including attacks on Cuba, SRV and North Korea as appropriate).

While it will remain our policy not to rely on launching nuclear weapons on warning that an attack has begun, appropriate pre-planning, especially for ICBMs that are vulnerable to a preemptive attack, will be undertaken to provide the President the option of so launching. (TS)

Flexibility. In addition to pre-planned options we need an ability to design nuclear employment plans on short notice in response to the latest and changing circumstances. This capability must be comprehensive enough to allow rapid construction of plans that integrate strategic force employment with theater nuclear force employment and general purpose force employment for achieving theater campaign objectives and other national objectives when pre-planned response options are not judged suitable in the circumstances. (S)

To assure that we can design such plans, our goal should be to have the following capabilities on a continuing basis in peacetime, during crises, and during protracted conflict:

- Staff capabilities, within all unified and specified commands which have nuclear forces, to develop operational plans on short notice and based on the latest intelligence.

- Staff capabilities at the seat of Government to support the NCA for coordinating and integrating the nuclear force employment for all commands.
- Intelligence and target development capabilities which permit damage assessment and acquisition of a broad range of targets, fixed and mobile, on a timely basis for military operations. (S)

Reserve Forces. Pre-planned options should be capable of execution while leaving a substantial force in secure reserve and capable of being withheld for possible subsequent use. The forces designated for the reserve should be the most survivable and enduring strategic systems consistent with the need for a flexible and varied reserve force capable of being effectively employed against a wide target spectrum and withheld if necessary for a prolonged period. The secure reserve force will be increased over the next two years to support a more flexible execution of our countervailing strategy. This will be done according to the Secretary of Defense's guidance. (TS)

Targeting categories. Overall targeting planning appropriate to implement a countervailing strategy will result in a capability to choose to put the major weight of the initial response on military and control targets. Military targets must be selected for the purpose of destroying enemy forces or their ability to carry out military operations. Strategic and theater nuclear forces should to the extent feasible be used in combination with, and in support of, general purpose forces to achieve that objective. (S)

More specifically, the following categories of military targets, with appropriate sub-options for different theaters, should be covered in planning:

- strategic and theater nuclear forces, including nuclear weapons storage;
- military command, control, communications, and intelligence capabilities;
- all other military forces, stationary and mobile;
- industrial facilities which provide immediate support to military operations during wartime. (TS)

In addition, pre-planned options, capable of relatively prolonged withhold or of prompt execution, should be provided for attacks on the political control system and on general industrial capacity. (TS)

There must be extensive and effective coverage in the pre-planned options of all categories. Methods of attack on particular targets should be chosen to limit collateral damage to urban areas, general

industry and population targets outside these categories, consistent with effectively covering the objective target, and, where appropriate, overall plans should include the option of withholds to limit such collateral damage. (TS)

Command, Control and Communications, and Intelligence. Flexibility in contingency planning and in operations will be highly dependent on our C³I capabilities, including their ability to acquire targets, assess damage, and survive attack. Strategic stability in an era of essential equivalence depends as much on survivability, endurance and reconstitutability of C³I capabilities as it does on the size and character of strategic arsenals. (C)

PD/NSC-53 directs that our C³I programs and our guidance to telecommunications common carriers support the development and maintenance of such capabilities. In addition, PD/NSC-41 directs that we seek greater continuity of government should deterrence fail. Implementation of PD/NSC-53 and PD/NSC-41 must be pursued in parallel with that of this employment directive. (C)

The relationship of acquisition policy to employment policy. Our acquisition programs must be evaluated in terms of their support for the employment policy ordered by this directive. The required flexibility, survivability, endurance, and target destruction capability must be taken into account in developing programs for acquiring nuclear weapons systems, and their supporting C³I systems, needed to support our countervailing strategy. (S)

Implementation. As new targeting capabilities are developed, and as our operational staffing support change to meet the foregoing directives, they must be reviewed and tested to validate their feasibility and soundness. For that purpose:

- At least two exercises involving the National Command Authorities should be conducted each year to evaluate our capabilities and our employment doctrines.
- Continued study and analysis of means to improve and refine our countervailing strategy of general conflict should be conducted by the Department of Defense.
- The results of these exercises, studies and analysis will provide the bases for modification and any further development of employment and acquisition policy.
- A report will be rendered to the President at least annually on our employment plans, including, but not limited to, on the size and capability of the reserve forces, the degree of flexibility available,

limiting factors in achieving flexibility, and the status of programs to provide improvements.

- Any change or new pre-planned options will be submitted to the President for his review and approval, in accordance with current procedures. (TS)

NSDM-242 is superseded by this directive. (U)

Jimmy Carter

NUCLEAR WAR STRATEGY

(Concerning President Carter's
25 July 1980 Presidential
Directive PD-59, "Nuclear
Weapons Employment Policy")

HEARING

BEFORE THE

COMMITTEE ON FOREIGN RELATIONS

UNITED STATES SENATE

NINETY-SIXTH CONGRESS

SECOND SESSION

ON

PRESIDENTIAL DIRECTIVE 59

SEPTEMBER 16, 1980

(TOP SECRET HEARING HELD ON SEPTEMBER 16, 1980; SANITIZED
AND PRINTED ON FEBRUARY 18, 1981)

Printed for the use of the Committee on Foreign Relations



APPENDIX

ADMINISTRATION'S RESPONSES TO QUESTIONS SUBMITTED BEFORE THE HEARING

Question 1. What are the basic strategic targeting priorities in PD-59? How do these differ from previous targeting guidance, particularly that contained in NSDM 242?

Answer. PD-59 specifies the development of plans to attack a comprehensive Soviet/Warsaw Pact target system, with the flexibility to employ these plans, should deterrence fail, in a deliberate manner consistent with the needs of the situation and in a way which will deny an aggressor any gain, or would impose costs which clearly exceed his expected gains. This could entail initial retaliation on military and control targets while retaining the capability either to withhold for a relatively prolonged period, or to execute, broad retaliatory attacks on the political control system and on general industrial capacity. These individual target systems, which we feel the Soviet leaders value most, include leadership and control, military forces both nuclear and conventional and the industrial/economic base. Highlights of targeting aspects include an increased number of situation-oriented options, and more flexibility for selectively attacking all categories of targets.

PD-59 requires the option to attack a full range of industrial/economic targets be retained. PD-59 also places more emphasis on how to improve the effectiveness of targeting retaliation against Warsaw Pact leadership and control, nuclear forces, and conventional forces in a wartime situation. In contrast to some pronouncements by the press, the United States has never had a doctrine based simply and solely on reflexive, massive attacks on Soviet cities. Instead, we have always planned both more selectively (options limiting industrial/economic damage) and more comprehensively (a range of military targets in addition to the industrial/economic base). Previous Administrations, going back well into the 1960s, recognized the inadequacy of a strategic doctrine that would give us too narrow a range of options. The fundamental premises of our countervailing strategy are a natural evolution of the conceptual foundations built over the course of a generation. PD-59 is not a new strategic doctrine; it is not a radical departure from past U.S. strategic policy. Our countervailing strategy, as formally stated in PD-59, is in fact, a refinement, a codification of previous statements of our strategic policy. PD-59 takes the same essential strategic doctrine, and restates it more clearly, more cogently, in the light of current conditions and current capabilities.

Question 2. What are the fundamental political and military objectives for strategic targeting in PD-59? Is it envisaged that the United States could, under certain circumstances, conduct limited nuclear war for foreign policy, political or military objectives? Does the PD-59 envision the possibility of U.S. nuclear retaliation for any provocation short of a nuclear attack on the United States or its allies?

Answer. Deterrence remains, as it has been historically, our fundamental strategic objective. The overriding objective of our strategic forces is to deter nuclear war. But deterrence must restrain an adversary from carrying out any of a far wider range of threats than just that of massive attacks of U.S. cities. We seek to deter any adversary from any course of action that could lead to general nuclear war. Our strategic forces also must deter nuclear attacks on smaller sets of targets in the United States or on U.S. military forces overseas, and deter the nuclear coercion of, or attack on, our friends and allies. Our strategic forces, in conjunction with theater conventional and nuclear forces, must also contribute to deterrence of conventional aggression as well. I say "contribute" because we recognize that neither nuclear forces nor the cleverest theory for their employment can eliminate the need for us—and our allies—to provide a capable conventional deterrent.

In our analysis and planning, we are necessarily giving greater attention to how a nuclear war would actually be fought by both sides if deterrence fails. There is no contradiction between this focus on how a war would be fought and what its results would be, and our purpose of insuring continued peace through deterrence. Nor is there a contradiction between this focus and a judgment that escalation of a "limited" to an "all-out" nuclear war is likely. Indeed, this focus helps us achieve deterrence and peace, by insuring that our ability to retaliate is fully credible. We must have forces, contingency plans, and command and control capabilities that will convince the Soviet leadership that no war and no course of aggression by them that led to use of nuclear weapons—on any scale of attack and at any stage of conflict—could lead to victory, however they may define victory.

Operationally, our countervailing strategy requires that our plans and capabilities be structured to put more stress on being able to employ strategic nuclear forces selectively, as well as by all-out retaliation in response to massive attacks on the United States. It is our policy—and we have increasingly the means and the detailed plans to carry out this policy—to ensure that the Soviet leadership knows that if they chose some intermediate level of aggression, we could, by selective, large (but still less than maximum) nuclear attacks, exact an unacceptably high price in the things the Soviet leaders appear to value most—their military forces both nuclear and conventional, their political and military control apparatus, and the industrial capability to sustain a war. In our planning we have not ignored the problem of ending the war, nor would we ignore it in the event of a war. And, of course, we have, and we will keep, a survivable and enduring capability to attack the full range of targets, including the Soviet economic base, if that is the appropriate response to a Soviet strike.

The United States already retains the option of using weapons in a limited way in response to a conventional attack on us or our allies if necessary. However, PD-59 does *not* propose a first strike strategy. We are talking about what we could and (depending on the nature of a Soviet attack) would do in response to a Soviet attack. Nothing in the policy contemplates that nuclear war can be a deliberate instrument of achieving our national security goals because it cannot be. But we cannot afford the risk that the Soviet leadership might entertain the illusion that nuclear war could be an option—or its threat a means of coercion—for them.

Question 3. What alternative targeting strategies were examined in the studies which preceded PD-59? On what grounds were such alternatives rejected? Was the President presented with alternatives to the targeting policy set forth in PD-59?

Answer. Alternative targeting strategies were addressed. The alternative strategies examined were: (a) strengthen existing policy; (b) focus more heavily on denying Soviets a favorable war outcome; (c) add higher confidence capability against some target systems; and (d) rely more heavily on assured destruction.

Under alternative (a) the forces and related C³I to accomplish this strategy would be given added endurance.

Alternative (b) placed more emphasis on targeting of Soviet (and non Soviet Warsaw Pact) nuclear and conventional forces to assure that they could not expect to achieve a favorable outcome or a victory, however victory might be defined, while retaining an assured destruction capability.

Alternative (c) would require greater capabilities against certain Soviet forces than in alternative (b).

The last alternative, (d), also would avoid the need to make any improvements to the flexibility and endurance of strategic forces and C³I.

Each of the alternatives was considered in light of: (a) what flexibility in our nuclear posture (i.e., how broad a range of options) is desired; (b) how much endurance do our forces and C³I require; (c) how much capability is considered necessary; (d) costs of achieving these capabilities.

These considerations were weighed against the ability of each of the alternatives to deter the Soviets, taking into account Soviet attitudes toward concepts of nuclear war and perceptions of our capabilities and will, as well as the perceptions of our friends and allies. In the final analysis, a policy was selected which was judged to be most realistic considering the current relationship between the U.S. and the U.S.S.R., and the world situation, and considering the continued aggressive pursuit by the Soviets of comprehensive improvement in all aspects of military force capabilities, both nuclear and conventional.

A belief in the continuing utility of war as a policy instrument and the need for military superiority fit well into Soviet discussions of victory in a global conflict. It should be noted that Soviet civilian leadership has made statements as to the destructiveness of nuclear war and the need for U.S.-U.S.S.R. arms control measures. At the same time, it is appropriate to take note of high level Soviet statements which tend to point to a somewhat different direction. For instance, the Chief of the Soviet Strategic Missile Forces has observed that:

The imperialist ideologists are trying to lull the vigilance of the world's people by having recourse to propoganda devices to the effect that there will be no victors in a future nuclear war. These false affirmations contradict the objective laws of history . . . Victory in war, if the imperialists succeed in starting it, will be on the side of world socialism and all progressive mankind. (Marshal of the Soviet Union N. I. Krylov, "The Instructive Lessons of History", *Sovetskaia Rossiia*, August 30, 1969, UNCLASSIFIED).

President (and Marshal of the Soviet Union) Brezhnev is also on record as saying that:

Let it be known to all that in a clash with any aggressor the Soviet Union will win a victory worthy of our great people, of the homeland of the October Revolution. (L. I. Brezhnev, Speech on the 50th Anniversary of the October Revolution, *Pravda*, November 4, 1967, UNCLASSIFIED).

In addition to such doctrinal presentations, the Soviet leaders make evident through their programs their concerns about the failure of deterrence as well as its maintenance, and their rejection of such concepts as minimum deterrence and assured destruction as all-purpose strategic theories. As Secretary Brown has indicated, what is most troublesome is the heavy emphasis in Soviet military doctrine on the acquisition of war-winning (whatever the duration of the conflict) capabilities, and the coincidence (in one sense or another of the word) between their programs and what have been alleged as the requirements of a deliberate war-winning strategy. This compilation of Soviet sources—which could be added to almost indefinitely—is sufficient to demonstrate that the Ogarkov quotation used in the speech quoted in the question was not an aberration. There are, to be sure, quotations to be found that indicate different views—partly because there are no doubt different views within the Soviet system, more often because they are addressed to different audiences. There is no question that the Soviet leadership understands that nuclear war would be immensely destructive and uncertain; it is to re-inforce that perception—and to add to it the conclusion, found only very infrequently if at all in public statements, that the U.S.S.R. could not fight and win such a war—that the countervailing strategy is directed.



FOR EXTERNAL PUBLICATION

Radio Moscow in Mandarin to China, Nov. 3, 1978.

"However, the fact is that China's digging deep tunnels can never protect the Chinese masses from nuclear bombing or even protect them from conventional heavy bombs."

* * * * *

Radio Moscow World Service in English, Nov. 16, 1978

"The U.S. Administration is going to launch a 5-year program of civil defense. - - - The only real safety for the Americans is strengthening friendship with the Soviet Union, not bomb shelters."

FOR INTERNAL PUBLICATION

Moscow Voyennyye Znaniya in Russian No. 5, May 1978, p. 33.

"It is appropriate to say that we still meet people who have an incorrect idea about defense possibilities. The significant increase in the devastating force of nuclear weapons compared with conventional means of attack makes some people feel that death is inevitable for all who are in the strike area. However, there is not and can never be a weapon from which there is no defense. With knowledge and the skillful use of contemporary procedures, each person can not only preserve his own life but can also actively work at his enterprise or institution. The only person who suffers is the one who neglects his civil defense studies."

B61 nuclear weapons ready for use (Los Alamos National Laboratory photo)



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DEPARTMENT OF DEFENSE

**POLICY GUIDANCE
FOR
THE EMPLOYMENT OF NUCLEAR
WEAPONS (NUWEP) (U)**

OCTOBER 1980

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(24 Oct 80)

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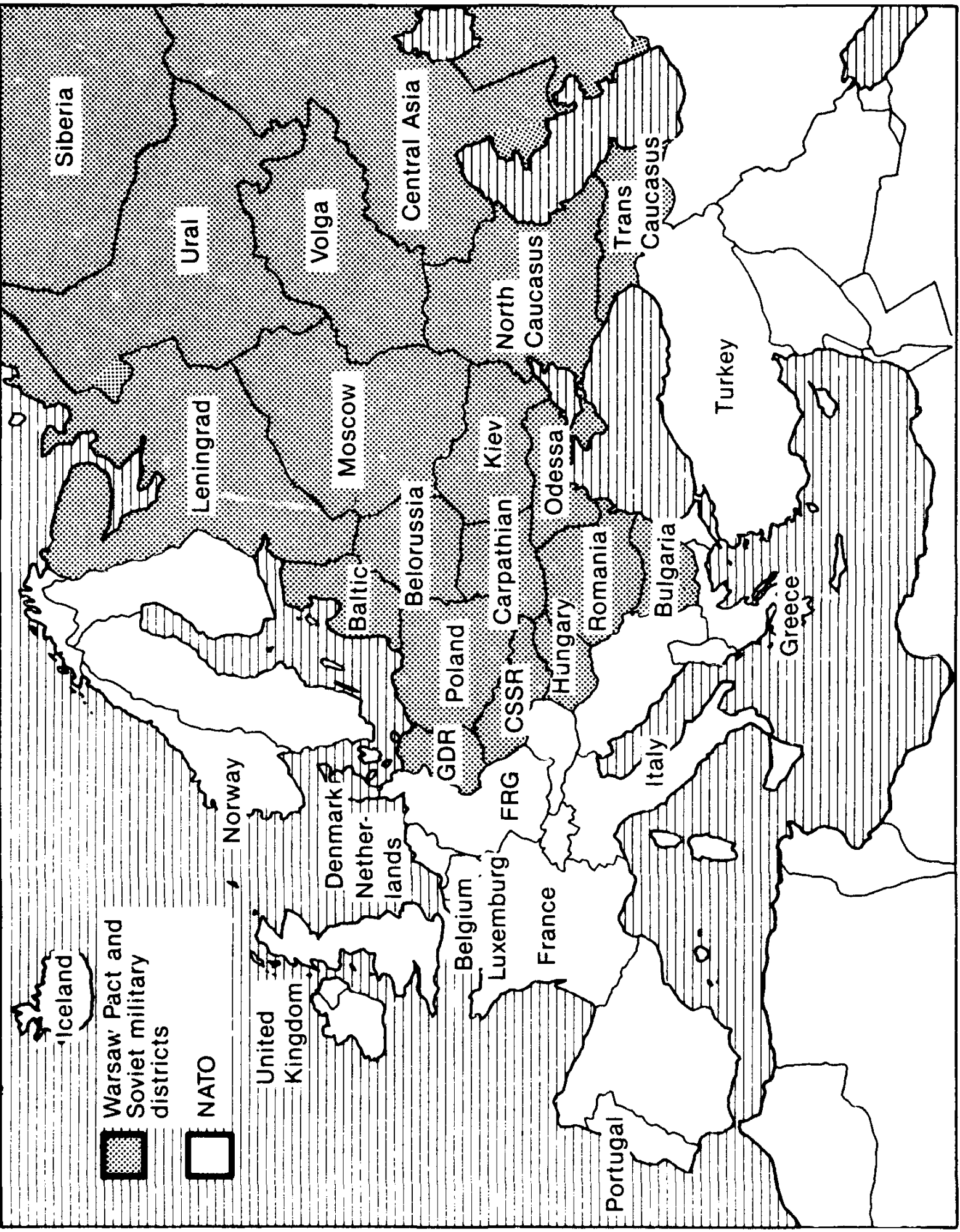
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IV. STRATEGY FOR EMPLOYMENT

A. Flexibility

(U) The U.S. must have the capability to respond appropriately and effectively to any level of Soviet aggression, over the continuum of nuclear weapon employment options, ranging from use of a small number of strategic and/or theater nuclear capable weapon systems in a contingency operation, to a war employing all elements of our nuclear forces in attacks against a broad spectrum of enemy targets. The ability to respond with selectivity to less than an all-out Soviet attack in keeping with the needs of the situation is required in order to provide the National Command Authorities (NCA) with suitable alternatives, strengthen deterrence, and enhance the prospects of limiting escalation of the conflict. In addition to pre-planned options we need an ability to design employment plans on short notice in response to the latest and changing circumstances. To advance the goal of flexibility, planning will provide an objective-oriented series of building block options for the employment of nuclear weapons in ways that will enable us to employ them consonant with our objectives and the course of the conflict.

(S) As it evolves, the building block approach should provide plans which satisfy a hierarchy of targeting objectives and which will provide the NCA an improved capability to employ nuclear weapons effectively in as measured and controlled a manner as feasible in case of a limited conflict. It should provide complementary elements which can be combined in an integrated and discrete manner to provide larger and more comprehensive plans for achieving politico-military objectives in specific situations. The building block approach places emphasis on the individual elements, their objective utility, and our ability to employ them separately or in total. However, this does not imply that the total plan be finely divisible--practical realities cannot be ignored. The desire for enhanced flexibility in employment must be balanced by practical consideration of the increased complexity incurred in planning and operations, the need to avoid compromising the effectiveness and workability of the larger options, and the need to maintain a responsive decisionmaking and force execution process.



Gorbachev's Economic Program: Problems Emerge

**CIA HISTORICAL REVIEW PROGRAM
RELEASE IN FULL
1999**

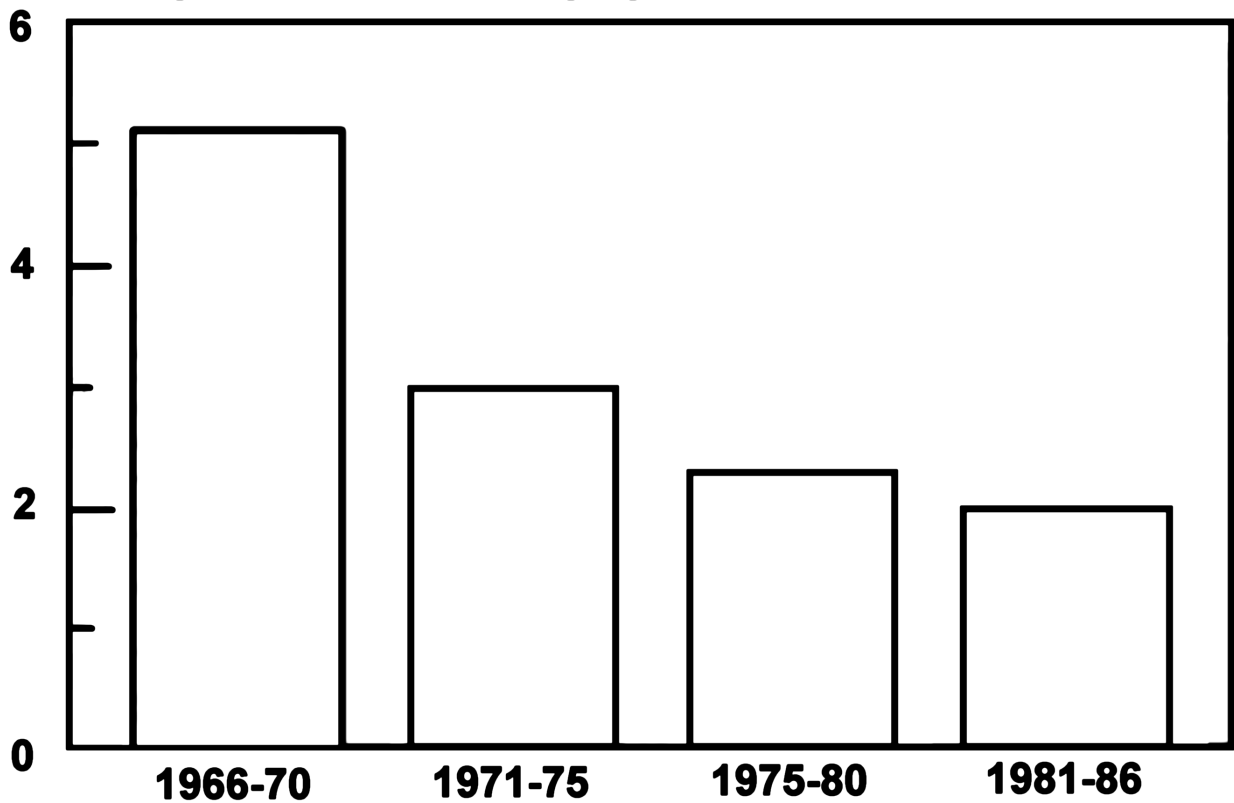


**DDB-1900-187-88
June 1988**

The Economic Slowdown

Trends in Soviet GNP, 1965-85

Average annual percentage growth



A Heavy Defense Burden

The Ratio of Selected Soviet to US

Cumulative Weapons Production, 1975-85

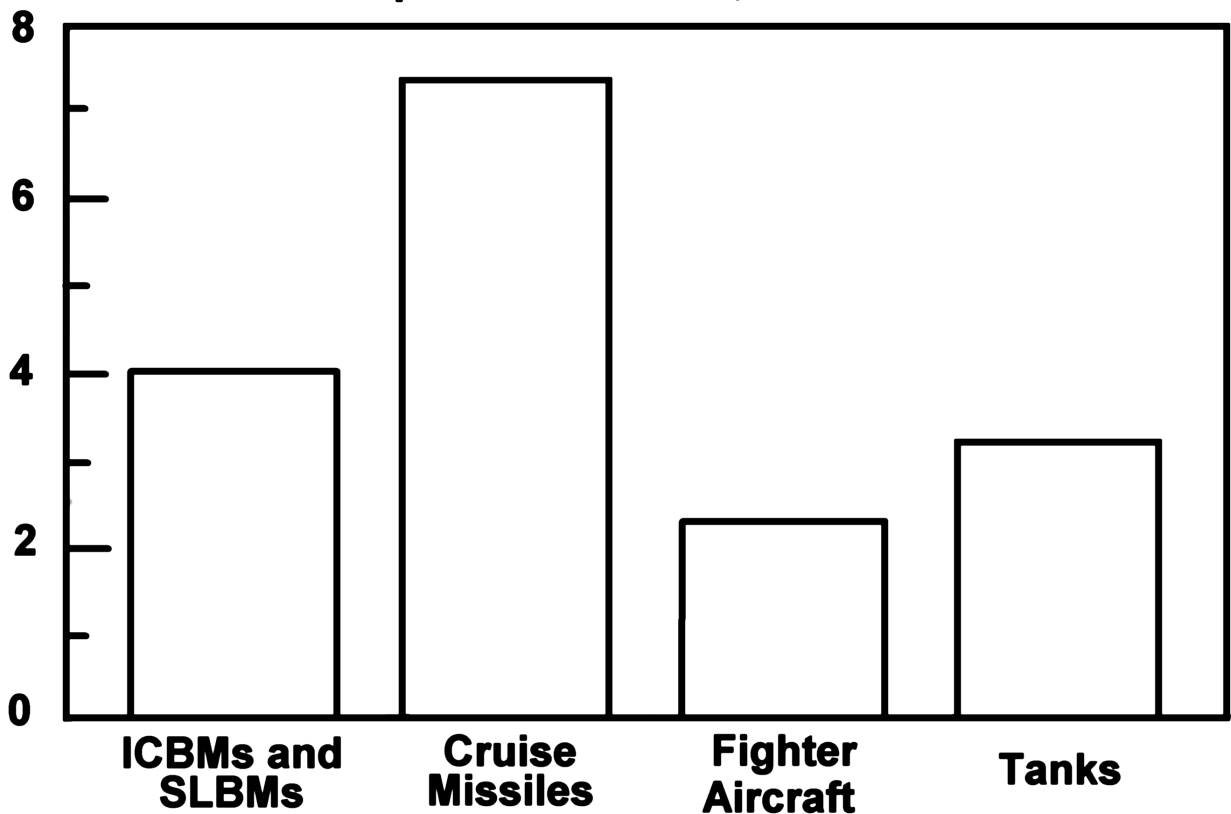


Figure 1. Gorbachev's Domestic Imperative

~~SECRET~~ ~~SENSITIVE~~

January 17, 1983

National Security Decision
Directive Number 75

Declass. and Release
under provision: E.O. 12356
by D. Van Tassel, National Security Council
894-1142

U.S. RELATIONS WITH THE USSR (S)

U.S. policy toward the Soviet Union will consist of three elements: external resistance to Soviet imperialism; internal pressure on the USSR to weaken the sources of Soviet imperialism; and negotiations to eliminate, on the basis of strict reciprocity, outstanding disagreements. Specifically, U.S. tasks are:

1. To contain and over time reverse Soviet expansionism by competing effectively on a sustained basis with the Soviet Union in all international arenas -- particularly in the overall military balance and in geographical regions of priority concern to the United States. This will remain the primary focus of U.S. policy toward the USSR.
2. To promote, within the narrow limits available to us, the process of change in the Soviet Union toward a more pluralistic political and economic system in which the power of the privileged ruling elite is gradually reduced. The U.S. recognizes that Soviet aggressiveness has deep roots in the internal system, and that relations with the USSR should therefore take into account whether or not they help to strengthen this system and its capacity to engage in aggression.
3. To engage the Soviet Union in negotiations to attempt to reach agreements which protect and enhance U.S. interests and which are consistent with the principle of strict reciprocity and mutual interest. This is important when the Soviet Union is in the midst of a process of political succession. (S)

In order to implement this threefold strategy, the U.S. must convey clearly to Moscow that unacceptable behavior will incur costs that would outweigh any gains. At the same time, the U.S. must make clear to the Soviets that genuine restraint in their behavior would create the possibility of an East-West relationship that might bring important benefits for the Soviet Union. It is particularly important that this message be conveyed clearly during the succession period, since this may be a particularly opportune time for external forces to affect the policies of Brezhnev's successors. (S)

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3. Political Action: U.S. policy must have an ideological thrust which clearly affirms the superiority of U.S. and Western values of individual dignity and freedom, a free press, free trade unions, free enterprise, and political democracy over the repressive features of Soviet Communism. We need to review and significantly strengthen U.S. instruments of political action including: (a) The President's London initiative to support democratic forces; (b) USG efforts to highlight Soviet human rights violations; and (c) U.S. radio broadcasting policy. The U.S. should:

-- Expose at all available fora the double standards employed by the Soviet Union in dealing with difficulties within its own domain and the outside ("capitalist") world (e.g., treatment of labor, policies toward ethnic minorities, use of chemical weapons, etc.).

-- Prevent the Soviet propaganda machine from seizing the semantic high-ground in the battle of ideas through the appropriation of such terms as "peace." (S)

B. Geopolitical

1. The Industrial Democracies: An effective response to the Soviet challenge requires close partnership among the industrial democracies, including stronger and more effective collective defense arrangements. The U.S. must provide strong leadership

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April 21, 1959 Cuban President Fidel Castro and Vice President Nixon



June 3, 1961: Nikita Khrushchev and John F. Kennedy in Vienna

S E C R E T

Extracts from Khrushchev's letter
to Kennedy, 26 October 1962
(Catalogue ref: PREM 11/3691)

QUOTE

Dear Mr. President:

I have received your letter of October 25. From your letter, I got the feeling that you have some understanding of the situation which has developed and (some) sense of responsibility. I value this.

Now we have already publicly exchanged our evaluations of the events around Cuba and each of us has set forth his explanation and his understanding of these events. Consequently, I would judge that, apparently, a continuation of an exchange of opinions at such a distance, even in the form of secret letters, will hardly add anything to that which one side has already said to the other.

I think you will understand me correctly if you are really concerned about the welfare of the world. Everyone needs peace: Both capitalists, if they have not lost their reason, and still more, Communists, people who know how to value not only their own lives but, more than anything, the lives of the people. We, Communists, are against all wars between states in general and have been defending the cause of peace since we came into the world. We have always regarded war as a calamity, and not as a game nor as a means for the attainment of definite goals, nor, all the more, as a goal in itself. Our goals are clear, and the means to attain them is labor. War is our enemy and a calamity for all the peoples.

It is thus that we, Soviet people, and, together with us, other peoples as well, understand the questions of war and peace. I can, in any case, firmly say this for the peoples of the Socialist countries, as well as for all progressive people who want peace, happiness, and friendship among peoples.

I see, Mr. President, that you too are not devoid of a sense of anxiety for the fate of the world, of understanding, and of what war entails. What would a war give you? You are threatening us with war. But you well know that the very least which you would receive in reply would be that you would experience the same consequences as those which you sent us. And that must be clear to us, people invested with authority, trust, and responsibility. We must not succumb to intoxication and petty passions, regardless of whether elections are impending in this or that country, or not impending. These are all transient things, but if indeed war should break out, then it would not be in our power to stop it, for such is the logic of war. I have

participated in two wars and know that war ends when it has rolled through cities and villages, everywhere sowing death and destruction.

In the name of the Soviet Government and the Soviet people, I assure you that your conclusions regarding offensive weapons on Cuba are groundless. It is apparent from what you have written me that our conceptions are different on this score, or rather, we have different estimates of these or those military means. Indeed, in reality, the same forms of weapons can have different interpretations.

You are a military man and, I hope, will understand me. Let us take for example a simple cannon. What sort of means is this: offensive or defensive? A cannon is a defensive means if it is set up to defend boundaries or a fortified area. But if one concentrates artillery, and adds to it the necessary number of troops. Then the same cannons do become an offensive means, because they prepare and clear the way for infantry to attack. The same happens with missile - nuclear weapons as well, with any type of this weapon.

You are mistaken if you think that any of our means on Cuba are offensive. However, let us not quarrel now. It is apparent that I will not be able to convince you of this. But I say to you: You, Mr. President, are a military man and should understand: Can one attack, if one has on one's territory even an enormous quantity of missiles of various effective radiuses and various power, but using only these means? These missiles are a means of extermination and destruction. But one cannot attack with these missiles, even nuclear missiles of a power of 100 megatons because only people, troops, can attack. Without people, any means however powerful cannot be offensive.

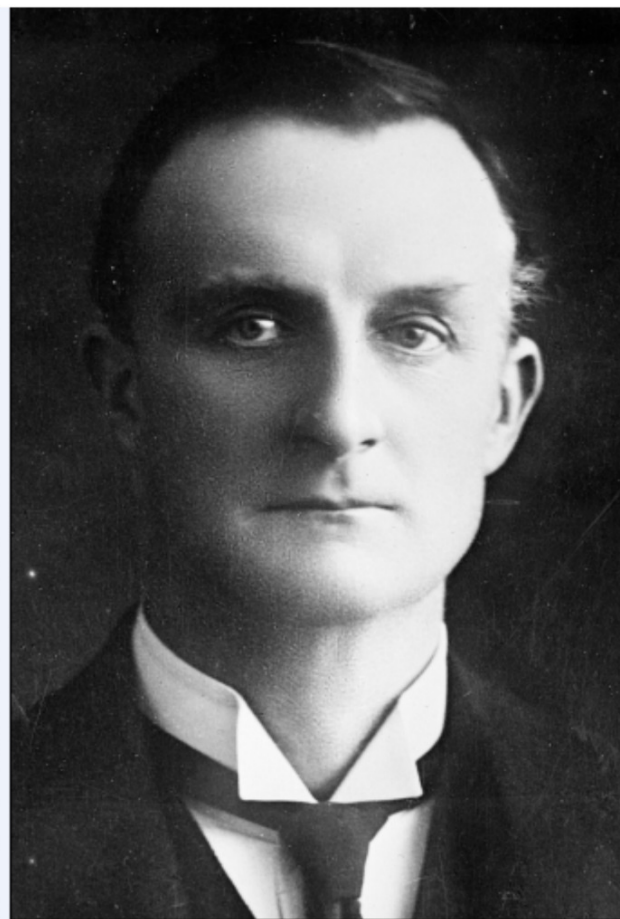
Armaments bring only disasters. When one accumulates them, this damages the economy, and if one puts them to use, then they destroy people on both sides. Consequently, only a madman can believe that armaments are the principal means in the life of society. No, they are an enforced loss of human energy, and what is more are for the destruction of man himself. If people do not show wisdom, then in the final analysis they will come to a clash, like blind moles, and then reciprocal extermination will begin.

Let us therefore show statesmanlike wisdom. I propose: We, for our part, will declare that our ships, bound for Cuba, will not carry any kind of armaments. You would declare that the United States will not invade Cuba with its forces and will not support any sort of forces which might intend to carry out an invasion of Cuba. Then the necessity for the presence of our military specialists in Cuba would disappear.

Stumbling into disaster: Britain's 1914 Cabinet



Liberal Prime Minister Herbert Asquith (married with 7 kids) was too busy writing FOUR love letters per Cabinet meeting to mistress Venetia Stanley, to pay attention to Britain's slide to war under Grey.

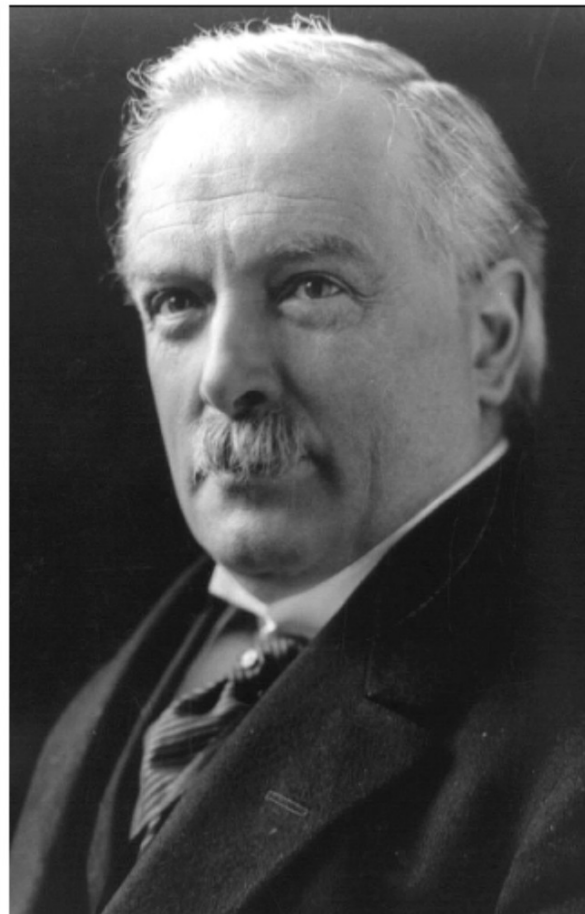


Fly-fishing Foreign Secretary Edward Grey was up to 1 August appeasing Germany into sparing France in exchange for UK neutrality, instead of warning we'd fight!

By the time Grey finally promised war if Germany invaded Belgium, it was too late: Germany had mobilized.



First Lord of the Admiralty Churchill was too busy preparing for war to check on Grey!

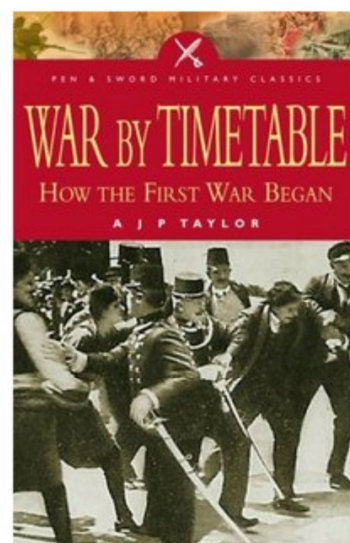


Chancellor of the Exchequer David Lloyd George: too busy with domestic affairs!

“These conflicts often threatened to bring the alliances into play. For example, if Russia attacked Austria-Hungary as the result of a quarrel over Bulgaria, would Germany be obliged to aid Austria-Hungary, as she had undertaken to do in the Austro-German alliance? Or if Germany attacked France as the result of a quarrel over Morocco, would Russia have to fulfil her promise under the Franco Russian alliance? On the whole, the various powers rejected such consequences. An attack which brought the conditions of the alliance into play would really have to be 'unprovoked aggression', in the later 20th-century phrase. Thus Bismarck steadfastly refused to promise support for Austria-Hungary in the Bulgarian troubles during the 1880s. If she wanted to oppose Russia, he said, she must find other allies- Great Britain and Italy. Later, Russia refused to support France in the two Moroccan crises of 1905 and 1911. France refused to support Russia in the Bosnian crisis of 1908.”

“These inexperienced strategists all held firmly to the dogma that their plans were immutable to the last detail and that improvisation of any kind was impossible. With each elaboration, they became still more the prisoners of their own time-tables. Mobilisation appeared to them a once-for-all operation. It had to be performed in a particular way and would then determine the entire shape of the war which followed.”

- A. J. P. Taylor, *War by Timetable*, 1969



“The nations slithered over the brink into the boiling cauldron of war without any trace of apprehension or dismay... The nations backed their machines over the precipice ... not one of them wanted war; certainly not on this scale.” - David Lloyd George, *War Memoirs*, 1934

Right:
Brooklyn Eagle
 July 1914
 newspaper
 cartoon, titled *A
 Chain of
 Friendship*,
 captioned: “If
 Austria attacks
 Serbia, Russia
 will fall upon
 Austria,
 Germany upon
 Russia, and
 France and
 England upon
 Germany.”





Prime Minister Chamberlain and Hitler, September 22, 1938, Bad Godesberg



Prime Minister Chamberlain's Foreign Office ordered British football team to give Nazi salute in 1938 Third Reich, for appeasement.



September 30, 1938 peace promise:

We, the German Führer and Chancellor and the British Prime Minister, have had a further meeting today and are agreed in recognising that the question of Anglo-German relations is of the first importance for the two countries and for Europe.

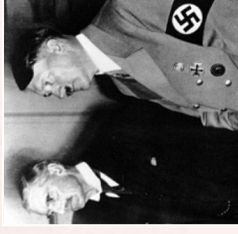
We regard the agreement signed last night and the Anglo-German Naval Agreement as symbollic of the desire of our two peoples never to go to war with one another again.

We are resolved that the method of consultation shall be the method adopted to deal with any other questions that may concern our two countries, and we are determined to continue our efforts to remove possible sources of difference and thus to contribute to assure the peace of Europe.

h
The

Neville Chamberlain

September 30, 1938.



The Munich agreement signed by Hitler, waved and cheered
(Prime Minister Neville Chamberlain at Heston Airport, 1938)

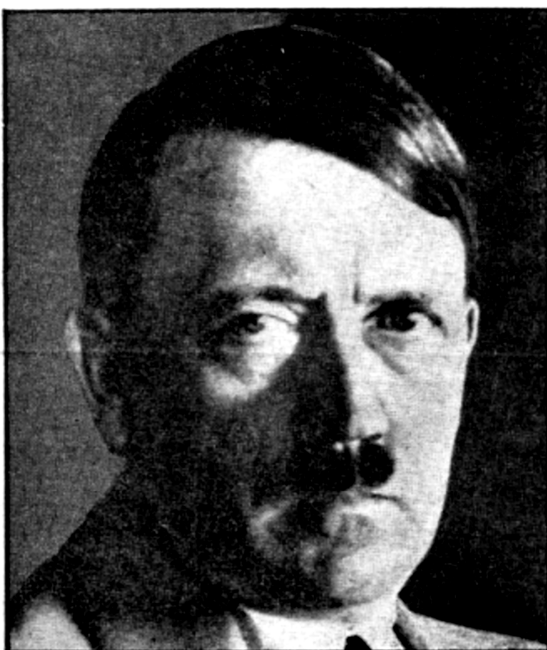


Hitler complained to Prime Minister Chamberlain about this BRITISH NEWSPAPER CARTOON by Low. Prime Minister Chamberlain then complained to the publisher, pressurizing for censorship



WANTED!

**FOR MURDER . . . FOR KIDNAPPING . . .
FOR THEFT AND FOR ARSON**



Can be recognised full face by habitual scout. Rarely smiles. Talks rapidly, and when angered screams like a child.

ADOLF HITLER ALIAS

Adolf Schicklegruber,
Adolf Hittler or Hidler

Last heard of in Berlin, September 3, 1939. Aged fifty, height 5ft. 8½in., dark hair, frequently brushes one lock over left forehead. Blue eyes. Sallow complexion, stout build, weighs about 11st. 3lb. Suffering from acute monomania, with periodic fits of melancholia. Frequently bursts into tears when crossed. Harsh, guttural voice, and has a habit of raising right hand to shoulder level. **DANGEROUS!**



Profile from a recent photograph. Black moustache. Jowl inclines to fatness. Wide nostrils. Deep-set, menacing eyes.

FOR MURDER

Wanted for the murder of over a thousand of his fellow countrymen on the night of the Blood Bath, June 30, 1934. Wanted for the murder of countless political opponents in concentration camps.

He is indicted for the murder of Jews, Germans, Austrians, Czechs, Spaniards and Poles. He is now urgently wanted for homicide against citizens of the British Empire.

Hitler is a gunman who shoots to kill. He acts first and talks afterwards.

No appeals to sentiment can move him. This gangster, surrounded by armed hoodlums, is a natural killer. The reward for his apprehension, dead or alive, is the peace of mankind.

FOR KIDNAPPING

Wanted for the kidnapping of Dr. Kurt Schuschnigg, late Chancellor of Austria. Wanted for the kidnapping of Pastor Niemöller, a heroic martyr who was not afraid to put God before Hitler. Wanted for the attempted kidnapping of Dr. Benes, late President of Czechoslovakia. The kidnapping tendencies of this established criminal are marked and violent. The symptoms before an attempt are threats, blackmail and ultimatums. He offers his victims the alternatives of complete surrender or timeless incarceration in the horrors of concentration camps.

FOR THEFT

Wanted for the larceny of eighty millions of Czech gold in March, 1939. Wanted for the armed robbery of material resources of the Czech State. Wanted for the stealing of Memelland. Wanted for robbing mankind of peace, of humanity, and for the attempted assault on civilisation itself. This dangerous lunatic masks his raids by spurious appeals to honour, to patriotism and to duty. At the moment when his protestations of peace and friendship are at their most vehement, he is most likely to commit his smash and grab.

His tactics are known and easily recognised. But Europe has already been wrecked and plundered by the depredations of this armed thug who smashes in without scruple.

FOR ARSON

Wanted as the incendiary who started the Reichstag fire on the night of February 27, 1933. This crime was the key point, and the starting signal for a series of outrages and brutalities that are unsurpassed in the records of criminal degenerates. As a direct and immediate result of this calculated act of arson, an innocent dupe, Van der Lubbe, was murdered in cold blood. But as an indirect outcome of this carefully-planned offence, Europe itself is ablaze. The fires that this man has kindled cannot be extinguished until he himself is apprehended—dead or alive!

THIS RECKLESS CRIMINAL IS WANTED—DEAD OR ALIVE!